PUBLICATIONS IN SCIENCE AND TECHNOLOGY BY FACULTY MEMBERS IN UNIVERSITIES OF JORDAN: A SCIENTOMETRIC STUDY

ABSTRACT

THESIS SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy

IN

LIBRARY AND INFORMATION SCIENCE

UNDER THE SUPERVISION OF
PROF. SHABAHAT HUSAIN

SUBMITTED BY
OMAR MOHD. AL-JARADAT
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DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE
FACULTY OF SOCIAL SCIENCES
ALIGARH MUSLIM UNIVERSITY, ALIGARH (INDIA)

2008

ABSTRACT

Science and Technology are generally recognized as important strategic factors determining the future development and welfare of nations. The terms 'knowledge society' and 'knowledge based economy' have been recently coined in order to bring into relief the crucial role of scientific knowledge in economic and social development of Nations. Developed countries, therefore, invest heavily in Science and Technology research and development programmes resulting into a sizable bulk of literature produced by the scientists and researchers of those countries. Collaboration at national and international level is suggesting ways of building Science and Technology capacity in developing countries also.

Jordan's concern with Science and Technology dates back to an early stage in the evolution of Jordanian state in 1921. Continued economic and social transformation and activating the investment of manpower and national resources available in Jordan, accelerated the efforts to institutionalize the national ambitions in Science and Technology field. The establishment of higher council for Science and Technology in the year 1987 confirmed the desire of the Jordanian state in making Jordan a center of excellence in many fields. Jordan has adequate infrastructure for the development of Science and Technology especially within the universities and centers of scientific research. As far as research activities in the universities are concerned, the faculty members' contribution is quite significant. At the moment Jordan has as many as 10 universities maintained by the Government of Jordan. In addition to that, there are 12 private universities, which also contribute to the development of Science and Technology.

Scientometric analysis of Science and Technology publications by the faculty of Jordanian universities provided dependable methods of measuring scientific activity in terms of the output of scientific publication.

The study was aimed at identifying and describing some of the characteristics of the literature published in the field of Science and Technology by the Faculty members of Jordanian Universities over a period of 11 years (1995-2005) with a view to identify most productive author, core journals, place, time, subject, country of origin of publications.

The basic objectives of the present study are as follows:

1. To know the most productive year/years of the literature/journal published on the subject.
2. To identify a list of core journals to study the scattering pattern of literature of the subject in different journals.
3. To determine the authorship pattern in the subject,
4. To find out the more used format of scientific documents.
5. To identify the different languages to know the dominating language in which most of the articles on the subject have been produced.
6. To identify ranked list of periodicals to know the core periodicals containing the most of literature on the subject.
7. To identify the interdisciplinary character of the subject
8. To study the rate of collaborative research that can be effectively measured from the number of authors in papers.
9. To understand most dominating countries in the scientific publications.
10. Assess the growth of the literature.

To conduct research on the topic "Publications in Science and Technology by Faculty Members in Universities of Jordan: A

Scientometric Study" the data had been collected from comprehensive and appropriate sources of literature in the field of Science and Technology. They are:-

- Abstract of Funded research projects at the University of Jordan
- Yarmouk University research publications
- Jordan University research publications (Database)
- Database of Arab periodicals "Yarmouk University"
- Funded Research Projects (Jordan University of Sciences and Technology)
- Index Mu'tah studies and research
- Index Dirasat
- Index Abhath al-Yarmouk
- Jordan National Bibliography

A database was developed using Oracle8i package. The data was collected, tabulated and analysed in order to conduct the following studies:-

Ranking of Periodicals:

The collected data included 5880 references published in 524 journals. The analysis shows that the most of the faculty members preferred to get their scientific contributions published in the periodicals issued from Jordan itself. The top 7 journals belong to the subjects namely Agriculture, Engineering, Medicine, Biology, and Pure Science. However, the journal titled 'Dirasat' published from the University of Jordan occupied number one position. The journal Dirasat in fact publishes articles into 5 main branches of Science and Technology in Arabic as well as in English. The reason of its popularity may be attributed to its feature that the abstract of the articles are published in both the languages in respect of the fact whether the article is in English or in Arabic.

Country-wise contribution

The study not only shows the leading countries bringing out the scientific outlook of Jordanian scholars but also shows their interest in publishing in widely distributed periodicals from as many as 51 countries. It was found out that about 35.74% contribution has been published in Jordanian periodicals. Second and third places are occupied by USA and UK respectively. The preference of the Jordanian scholars for publishing in Jordanian periodicals is probably due the fact that they prefer to publish both in English as well as in Arabic.

Subject-wise distribution

"Ulrich International Periodicals' Directory" (2004) has been used to ascertain the subject fields of the periodicals. The study shows that the faculty members of Jordanian Universities publish their scientific literature in as many as 25 subject areas. Most of the contribution amounting to 13.58% of the total was found to be in the field of Science and Technology. Engineering followed this with 10.58%, Mathematics with 9.91% and Medical Sciences with 9.60%. The findings indicate that the Jordanian faculty members are more interested in the subjects of general nature like Science and Technology. They seem to be less interested in the recently developed subjects like Plastic and Ceramic etc.

Language-wise Distribution:

The analysis of the data showed that English is the most preferred language of scientific communication amongst the faculty members of Jordanian Universities because 93.36% of the total items were published in English. Arabic as only the second language of preference for scholarly communication was found to constitute only 4.76% of the total contribution.

The above finding seems to be quite interesting because although the native language of Jordan is Arabic but the Scientists working in Jordanian universities are well versed in English language. It is probably because of the fact that English language has worldwide acceptability.

Year-wise distribution

The study revealed a steady growth in the production of literature by Jordanian scientists under the purview. It was found that their total contribution in 1995 was 384 items where as in 2005 it increased to 789 items (i.e. from 6.03% to 12.40%), thus showing a doubling of published output. This type of growth may be attributed to a number of factors such as (i) increase in the number of universities (i.e. from 5 in 1995 to 10 in 2005); (ii) policies of the government; (iii) personal interest of faculty members to achieve international recognition.

Form-wise Distribution

It was noted that the periodical articles are the most popular form of scientific contribution amongst Jordanian faculty members as 92.43% of the total items are published as articles in scientific journals. The next preference is that of 'conference proceedings' constituting only 6.64% of the total items published. The books with a meager 0.91% occupy the third place only.

Ranking of Authors

The study shows that the first rank is occupied by Jamal R. Qasem (Department of Agriculture, University of Jordan) with 36 items published to his credit while the second rank with 33 publications is occupied by Mustafa, H. (Department of Physics, University Jordan) and the third place with 31 items each is occupied by as many as 6 authors.

The same study was also conducted with a different angle in which subject wise productivity of authors was found out. The results showed three most active researchers / scientists in each of 14 different fields of studies like Agriculture, Biology, Chemistry, Computers, Dentistry, Earth Sciences, Electronic, Engineering, Mathematics, Medical Sciences, Microbiology, Nursing, Pharmacy and Pharmacology, Physics.

Single verses multiple authors' contribution was also studied. The results indicated that the faculty members of Jordanian universities preferred to work mostly independently.

The findings of the study make it amply clear that the faculty members of Jordanian Universities in general, like to get their scientific contributions published in the periodicals issued from Jordan itself. This is evident from the fact that research articles of Jordanian scholars are published in widely distributed periodicals from as many as fifty-one countries but the seven core periodicals in which their contributions have been published are from Jordan itself.

'Dirasat' published from the University of Jordan occupies the first position amongst the top seven core periodicals. This journal, infact separately covers five main branches of Science and Technology. This and other reasons of its popularity are- its inclusion of articles in Arabic as well as in English; as also the fact that it publishes abstracts in both the languages, irrespective of the fact whether the articles themselves are written in English or in Arabic language.

The research also concluded that the scientists undertake their researches more in the fundamental subjects of Science and Technology as compared to those in newly developed subject fields. The reason attributed to it is the availability of research facilities in those subjects. Another startling revelation of the present research was the preference of the Jordanian scholars to get their research published in English rather than in their native language. It is probably because of

the fact that the publications in English language have their worldwide acceptability and thus they easily get global recognition. However, the journal 'Dirasat: Pure Sciences' has published as many as 355 items in English and only 51 items in Arabic, authored by the Jordanian Faculty members under study. Jordanian Scientists reported steady growth in the production of literature during the period of study. Even the published output was reported to have been doubled during the period from 1995 to 2005. This is mainly due to increase in the number of universities and policies of the government to invest heavily in S&T research and development programmes, i.e. 4% of the total budgetary allocation. The research articles were found to be the most common form of scientific communication by the Faculty members. The second place was occupied by the conference proceedings. In contrast to the recent trend of collaborative research followed by the scientists the world over, Jordanian Scholars were found to conduct solo research. This deviation is probably due to the criteria of giving 100% weightage to single author contributions in matters of promotion of Faculty members from lower to higher cadre.

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2008


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To my dear loving family

Members and my

Venerable supervisor who

Gave their today

for my

Better tomorrow

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Ex-CHAIRMAN

Ref. No. .....

Dated .....

Certificate

This is to certify that the thesis entitled "**Publications in Science and Technology by Faculty Members in Universities of Jordan: A Scientometric Study**" submitted in fulfillment of the requirements for the award of the degree of **Doctor of Philosophy in Library and Information Science** of the **Aligarh Muslim University,** is the original work of research carried out by **Mr. Omar Mohd. Al-Jaradat** in the Department of Library and Information Science, Aligarh Muslim University, Aligarh (INDIA) under my supervision and guidance.

To the best of my knowledge, no part of this thesis has been submitted in any other University / Institution for the award of any other degree. I deem this work fit for the award of Doctor of Philosophy in Library and Information Science.

S. Husain

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CONTENTS

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Omar Mohd. Al-Jaradat

LIST OF TABLES

LIST OF DIAGRAMS

LIST OF ABBREVIATIONS

GOP	Gross Domestic Product
GRS	German Research Society
GRS	German Research Society
H.K.	Hashemite Kingdom of Jordan
HCST	Higher Count for Science and Technology
ISRDF	Industrial Scientific Research and Development Fund
ITC	International Translation Center
LAR	Library Association Record
NFES	National Fund for Enterprises Supports
NRH	His Royal Highness
PLO	Palestine Liberation Organization
R&D	Research and Development
RSS	Royal Scientific Society
S&T	Science and Technology
SCI	Science Citation Index
SSCI	Social Science Citation Index
UDC	Universal Decimal Classification
UNESCO	United Nation Education Scientific and Cultural Organization

Chapter One

Introduction, Objectives, Hypothesis & Methodology

CHAPTER ONE

INTRODUCTION, OBJECTIVES, HYPOTHESIS AND RESEARCH METHODOLOGY

1.1 INTRODUCTION

Science and Technology are generally recognized as important strategic factors determining the future development and welfare of nations. The terms "Knowledge society" and "knowledge-based economy" have been recently coined in order to bring into relief this crucial role of scientific knowledge and innovation in economic progress and social development (Fronk, 2003)[1] Science and Technology (S and T) play an important role in the development of nations. Developed countries therefore invest heavily in (S and T) research and development (R and D).

The main measures of scientific development are R and D expenditure, the ratio of gross domestic expenditure on R and D to gross domestic product (GDP), the number of personnel involved in (S and T) research, scientific publication output, and numbers of patents registered in the international patent systems. Among these indicators, R and D expenditure and scientific publication output seem to be the most clearly defined and least controversial. The reliability and breadth of statistical data on which (S and T) indicators are based leave much to be desired (Barre, 1998)[2]. Most statistical data (even for the strict domain of scientific research) are not linked to any social, cultural, or economic purpose; for example, the international mobility of scientists or the R and D networks of multinational companies are generally not considered. The standard indicators of (S and T) activity have inbuilt biases that often penalize or under represent work in developing countries. This is due, in part, to the presence of (S and T) activities in

the networks of power that are dominated by the developed countries. Furthermore, each indicator represents only one facet of a complex reality, and often multiple indicators must be examined together to obtain a more realistic picture of each country's (S and T) profile.

Measures of international collaboration are suggesting ways of building (S and T) capacity in the developing world: researchers from advanced countries collaborating with counterparts in developing countries report that these activities make a real contribution towards building international level (S and T) capacity in those countries. Indicators show that collaborative research between scientists in advanced and developing countries is expanding (Wilson and Osareh, 2003)[3]. Further, the number of (S and T) publications produced jointly by scientists in these countries is also rising. The governments of many developing countries recognize the critical importance of local institutions and specialists being able to identify, adapt, and effectively use the (S and T) achievements of industrialized nations and to develop their own unique technologies.

Knowledge pertaining to Science and Technology has expanded and advanced at an increasing pace since the end of the last century. The field of Science and Technology has witnessed a qualitative shift in the generation of information and knowledge and its investment has led to significant changes in productive methods. This has had a profound impact on the social and natural environment. The gap between the human capacity to invest Scientific and Technological expertise in meeting ever-increasing demands and safeguarding environmental and social balance has widened. With the end of the century has come the first implantation of the image of scientific and technological dependency. Among the salient features of the end of the twentieth century is the affirmation of the reality of Science and Technology (S and T) as the major pillar of development in its different activities.

Jordan's concern with (S and T) dates back to an early stage in the evolution of the Jordanian state (Mulki, 2006)[4]. The attainment of independence and the stabilization of Jordan's political entity at the end of the forties were followed by the move towards building a modern state. The development stage of Jordan began in fifties when first investments were made in the exploitation of its natural resources and establish heavy industries depending on the intensified use of the technology available at that time. Beginning of the sixties, witnessed the state to develop the most important resources i.e. manpower –with the establishment of the first national university. The developmental process continued with the establishment of the necessary institutions and infrastructure and the growth of productive sectors. At the onset of the seventies, in recognition of the significance of S&T at the highest level of leadership, the Royal Scientific Society (RSS) was established as the first national scientific research center aimed at intensifying national efforts in (R and D), and industrialization as well as providing (S and T) services and participating in the construction of a national scientific and technological base.

With continued economic and social transformation and the move towards evolving developmental tools and their inputs and activating the investment of manpower and national resources available to Jordan, efforts were directed towards the institutionalization of national ambitions in the (S and T) field. Science and Technology assumed its natural place as the essential cornerstone of national development, especially as Jordan is opening up and good relations at the regional and international levels allowed it for remarking the distinct impression of (S and T) on the achievement and rise of societies. The establishment of the Higher Council for Science and Technology (HCST) at the end of the eighties confirmed the interest of the Jordanian state in making Jordan a center of excellence in many fields.

Jordan has adequate infrastructural base for (S and T), especially within the universities and centers of scientific research. Research Development activity in Jordan is still modest, both quantitatively and qualitatively, and in most cases does not serve the developmental effort but is directed to basic or academic knowledge. National expenditure on R and D is still at the lowest level, at best not exceeding 0.35 per cent of the gross national income; whereas the globally acceptable level for developing countries reaches one per cent in accordance with the recommendations of specialized international organizations.

Scientometrics analysis of Science and Technology publications in Jordan provide dependable methods of measuring scientific activity in terms of the output of scientific publications that may serve as one indicator of country's (S and T) activity. Scientometrics, the quantitative study of science and technology through its published literature, uses various (S and T) databases to show, inter alia, a country's share of world's total publication count.

Librarians usually ignore the inclusion of bibliometric in their practical work, though it is very useful for planning of information provision. The reasons behind the non-use of bibliometrics, are time consuming and sometimes difficult to perform; another problem is that the results of bibliometrics studies give a simplified picture of a complex reality and must take into account many variables to be useful in practice (Sara, 1995).[5] The bibliometric methods, however, give opportunities to describe the content, structure and development of research and is becoming one of the most important on the basis of collection development in research libraries. These individuals, who develop library collection, data or information services, would have difficulties in knowing which material should be included especially in case of little concern scientists about the definition of the field. In such cases bibliometrics provide the needed tools for identifying the core

collection in such fields. The vast amount of documents available through many networks gives possibilities to apply bibliometrics within framework of the librarians' daily work.

1.2 STATEMENT OF THE PROBLEM

"Publications in Science and Technology by Faculty Members in Universities of Jordan: A Scientometric Study".

1.2.1 TERMS USED IN THE STATEMENT OF RESEARCH PROBLEM

1.2.1.1. Scientific

a. Pertaining to science or the sciences: scientific studies.

b. Occupied or concerned with science: scientific experts.

c. Regulated by or conforming to the principles of exact science: scientific procedures.

d. Systematic or accurate in the manner of an exact science. (http://dictionary.reference.com).[6]

1.2.1.2 Literature

a. Writings in which expression and form, in connection with ideas of permanent and universal interest, are characteristic or essential features, as poetry, novels, history, biography, and essays

b. The entire body of writings of a specific language, period, people, etc.: the literature of England

c. The writings dealing with a particular subject: the literature of ornithology

d. The profession of a writer or author

e. Literary work or production

f. Any kind of printed material, as circulars, leaflets, or handbills: literature describing company products

g. Archaic Polite learning; literary culture; appreciation of letters and books.

1.2.1.3. Science

a. The intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment

b. A systematically use of scientific knowledge in industry and everyday life. (Concise Oxford English Dictionary, 2004).[7]

c. A branch of knowledge or study dealing with a body of facts or truths systematically arranged and showing the operation of general laws: the mathematical sciences.

d. Systematic knowledge of the physical or material world gained through observation and experimentation

e. Systematized knowledge in general

f. Knowledge, as of facts or principles; knowledge gained by systematic study

g. A particular branch of knowledge

h. Skill, especially. Reflecting a precise application of facts or principles and proficiency.

1.2.1.4. Technology

a. The practical use of scientific knowledge in industry and everyday life.

b. Practical sciences as a group. (Chambers 21st Century Dictionary, 2004).[8]

c. The branch of knowledge that deals with the creation and use of technical means and their interrelation with life, society, and the environment, drawing upon such subjects as industrial arts, engineering, applied science, and pure science

d. The terminology of an art, science, etc.; technical nomenclature

e. A technological process, invention, method, or the like

f. The sum of the ways in which social groups provide themselves with the material objects of their civilization.

1.2.1.5. Faculty Members

An educator who works at a college or university.

1.2.1.6. Universities

a. An institution for higher learning with teaching and research facilities constituting a graduate school and professional schools that award master's degrees and doctorates and an undergraduate division that awards bachelor's degrees

b. The body of students and faculty of such an institution

c. The buildings and grounds of such an institution.

1.2.1.7. Jordan

a. The official name is: **Hashemite Kingdom of Jordan,** a country in South West of Asia, consisting of the former Trans-Jordan and a part of Palestine till the 1967, which has been occupied by Israel. Its capital is Amman city.

b. Jordan River is a river in South West Asia, flowing from South Lebanon towards the South between Israel and Jordan through west of Jordan into the Dead Sea of 320 km long.

1.2.1.8. Scientometrics: Scientometrics is the science of measuring and analyzing science. In practice, scientometrics is often done using bibliometrics that is measurement of (scientific) publications.

1.2.1.9. Study

A. Application of the mind to the acquisition of knowledge, as by reading, investigation, or reflection: long hours of study

B. The cultivation of a particular branch of learning, science, or art: the study of law.

C. Research or a detailed examination and analysis of a subject, phenomenon, and so on,

D. A well-defined, organized branch of learning or knowledge.

E. An inquiry, research, reading, thought consideration

1.3 PURPOSE AND SCOPE OF THE STUDY

Bibliometrics have been used in novel ways to assist with the evaluation of so many subjects. As the link between science and technology represents a major strategic stake, so the relation between scientific bibliographic reference and technical bibliographic references can be of very important documentary interest. This study is to present the most important modifications in this correspondence, in particular will allow linking several indexation fields with one of the most complete representation of classifications. Bibliometric methods are seldom used by librarians in practical work. The needs to organize this information and to help the user to identify relevant documents grows more important, and at the same time the huge amount of available documents give great possibilities to apply bibliometrics easily and in the frame of practical work. Bibliometrics provide a tool for getting the core for developing a local collection in a new field.

This study deals with the basic elements, that constitute the foundation for bibliometric analyses' the document being analyzed, and the tools that are applied for the data collection. The concepts of bibliometrics theory and link theory are to be discussed through a study of the current literature. The purpose of this study is aimed at conducting bibliometrics studies on the published output of the faculty members of the Jordanian Government Universities, specifically in the fields of science and technology. The study would be an empirical work in the frame of a project, which could be for instance collection development in an interdisciplinary field. To be more specific, this study deals with the problem of use of bibliometrics in the aforesaid Jordanian universities teaching staff as a retrieval source of information. This study would be the first of its kind to be conducted in the government; universities in the field of science and technology in relation teaching staff and this study would try to know the opinions of the concerned staff in the usefulness of such study.

1.4 OBJECTIVES OF THE STUDY

This study aims at identifying and describing some of the characteristics of the literature published in the field of 'Science and Technology' over a period of 11 years (1995-2005) with a view to identify most productive authors, core journals, place, time, subject, area and country of origin, from where the documents, are being published.

This study would be of great benefits to the researchers and particularly to those scientists who are engaged in research in science and technology in Jordan Output would give a wide scope to the teachers.

The basic objectives of the present study are as follows:

1. To know the most productive year/years of the literature/journal published on the subject.
2. To identify a list of core journals to study the scattering pattern of literature of the subject in different journals.
3. To determine the authorship pattern in the subject,
4. To find out the more used format of scientific documents.
5. To identify the different languages to know the dominating language in which most of the articles on the subject have been produced.
6. To identify ranked list of periodicals to know the core periodicals containing the most of literature on the subject.
7. To identify the interdisciplinary character of the subject
8. To study the rate of collaborative research that can be effectively measured from the number of authors in papers.
9. To understand most dominating countries in the scientific publications.
10. Assess the growth of the literature

1.5 HYPOTHESIS OF THE STUDY

While making bibliometric analysis, we find it to be of fundamental importance that some specific aspects are kept in mind in order to state clearly, what has to be examined. The following hypothesis has therefore been developed:-

Hypothesis-1

Most of the contributions of the faculty members of Jordanian Universities of Science and Technology are published in the journals brought out from Jordan.

Hypothesis-2

The faculty members like to publish significantly in the foreign journals also.

Hypothesis-3

The faculty members in Jordanian Universities mostly do their researches in newly developed subjects.

Hypothesis-4

Most of the faculty members like to publish in their native language.

Hypothesis-5

The periodicals carrying the publications of faculty members are mostly brought out in Arabic language.

Hypothesis-6

The period of study (1995-2005) shows a steady growth in the production of scientific literature by the faculty members of Jordanian Universities.

Hypothesis-7

The Faculty members of Jordanian Universities prefer to publish their contributions in form of research articles.

Hypothesis-8

The productivity of the authors is linked with the subjects that mostly contribute to the development of Jordan.

Hypothesis-9

The faculty members of Jordanian Universities believe more in collaborative research as compared to individual research.

Hypothesis-10

The bibliometric laws when applied to the published output of the Faculty members of Jordanian universities are found to be valid.

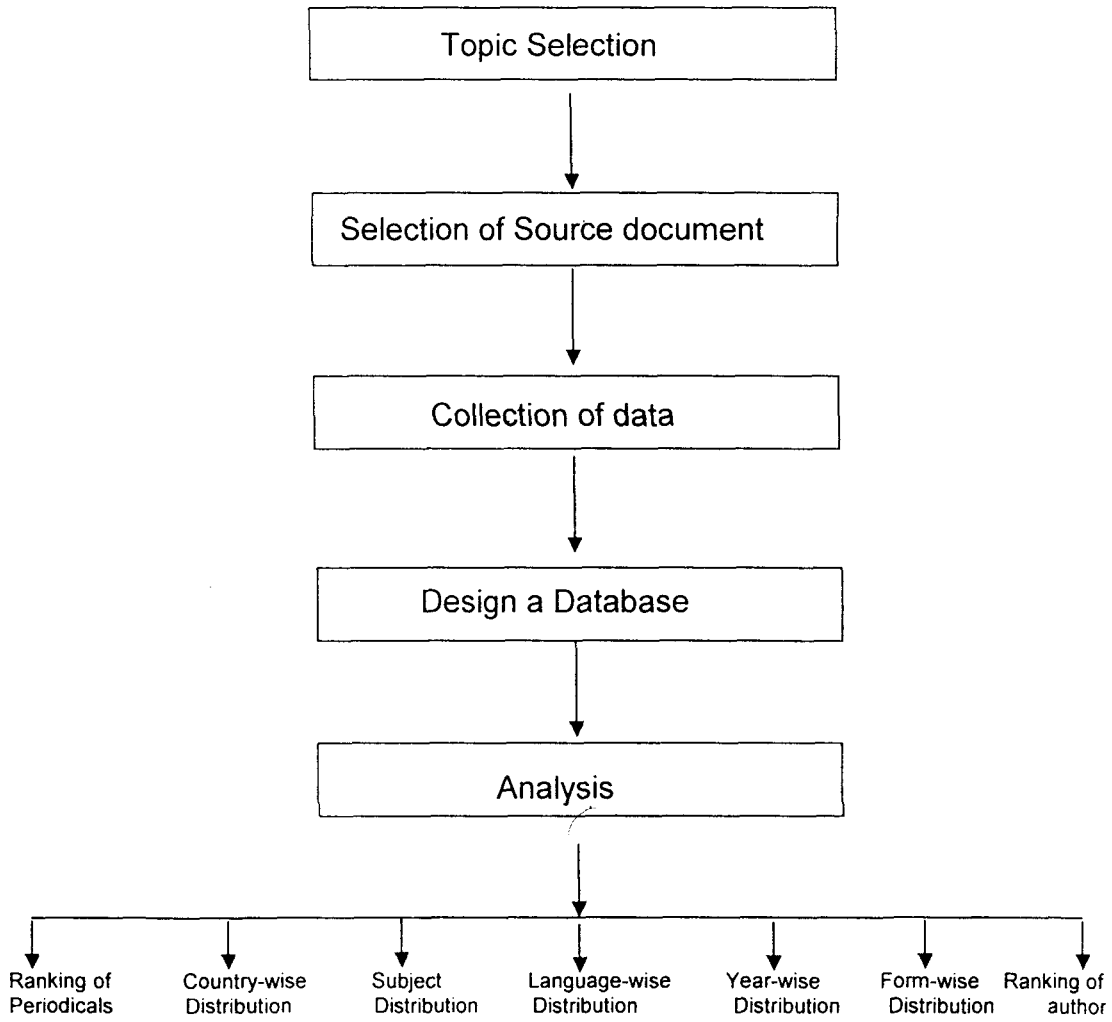
1.6 RESEARCH METHODOLOGY AND PROCEDURES

Scientometrics is used to measure scientific activities, mainly by producing statistics on scientific publications indexed in databases. They are flexible tools used to study the sociological phenomena associated with scientific communities, to conduct scientific/strategic, technical, technological or competitive monitoring, to design and manage research programs and to evaluate research. They are extremely valuable methods for evaluating research output, positioning studies and conducting foresight studies in science and technology.

Scientometric tools can be used to measure and compare the scientific activities at various levels of aggregation including institutions, sectors, provinces and countries. They can also be used to measure research collaborations, to map scientific networks and to monitor the evolution of scientific fields. Scientometric indicators give policy-makers objective, reproducible and verifiable information. Scientometrics specializes in the production and analysis of scientometric data. This expertise enables to extract value-added information on scientific activities from various databases of scientific publications. Scientometrics develops and utilizes advanced scientometric methods (controlled / normalized vocabulary and keyword co-occurrence analysis) to delineate and measure scientific activities in very specific or emerging fields.

In this study, mathematical and statistical methods are used for measuring quantitative and qualitative work published in books, journals and others. By using analysis, it is, for instance, possible to measure the scattering of articles in different journals so as to measure the growth and obsolescence of literature in the field of Science & Technology. The following procedures and methods will be used in the present study.

The methodology for conducting this scientometric study has been diagrammatically represented below:



(A) Selection of Topic

Lot of research in Science and Technology is being conducted in Jordan. But there has hardly been a study to find out the bibliometric or more appropriately Scientometric trends. Hence, the Topic "Publications in Sciences and Technology by Faculty Members in Universities Jordan: A Scientometric Study" has been selected for study.

(B) Selection of Source document

To conduct research on the topic "Publications in Science and Technology by Faculty Members in Universities of Jordan: A Scientometric Study" the data had been collected from comprehensive

and appropriate sources of literature in the field of Science and Technology. They are:-

- Abstract of Funded research projects at the University of Jordan
- Yarmouk University research publications
- Jordan University research publications (Database)
- Database of Arab periodicals "Yarmouk University"
- Funded Research Projects (Jordan University of Sciences and Technology)
- Index Mu'tah studies and research
- Index Dirasat
- Index Abhath al-Yarmouk
- Jordan National Bibliography

(C) Collection of data

The most important task is to select the documents from which data has been drawn on the subject Science & Technology. Research publications, abstracting and Indexing sources, databases, bibliographical sources published from Jordan are consulted for that purpose.

(D) Database Design

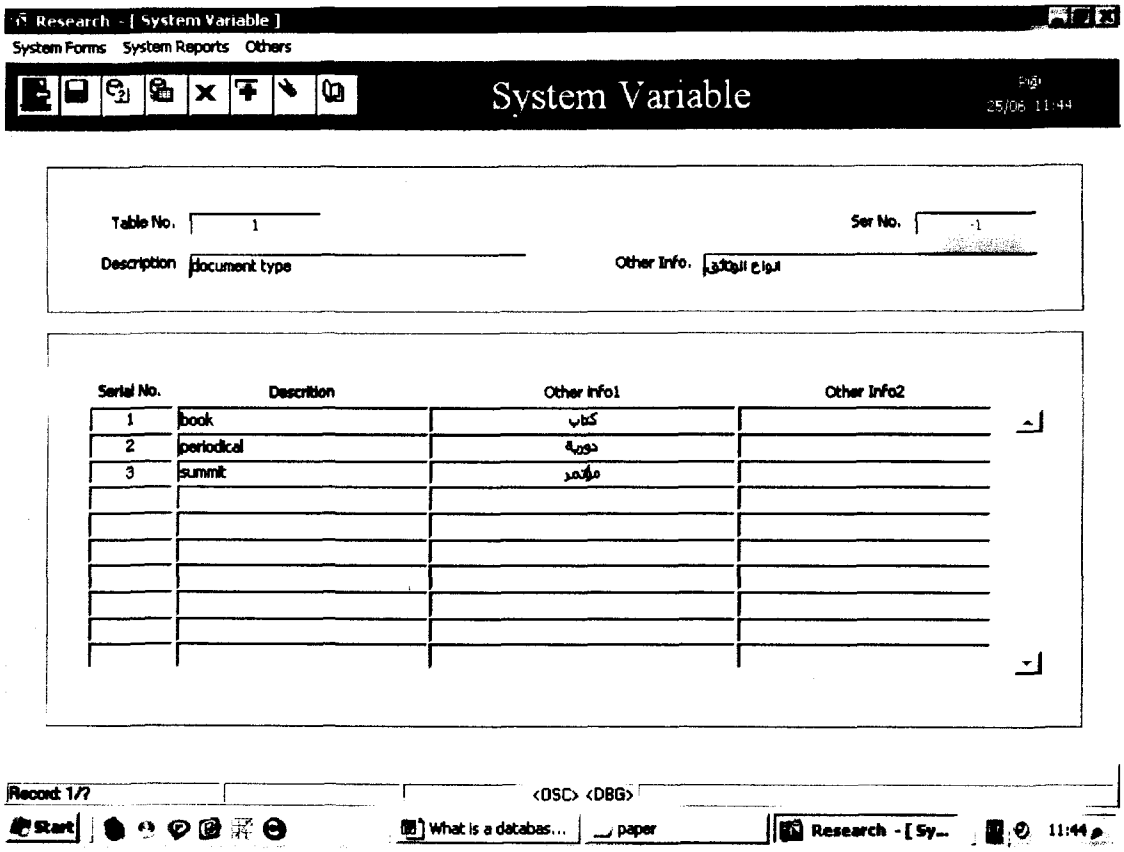
To fulfill the information needs, an organization needs to save information about its employees, departments, locations, customers, and invoices .This pieces of information are called data. A database stores data that is useful to us to develop the database, 'Oracle8i Package has been used for the purpose. This package has a number of tools that allow the users to create database object, Forms, Reports, Graphs, etc.

Some of the tools of oracle are:-

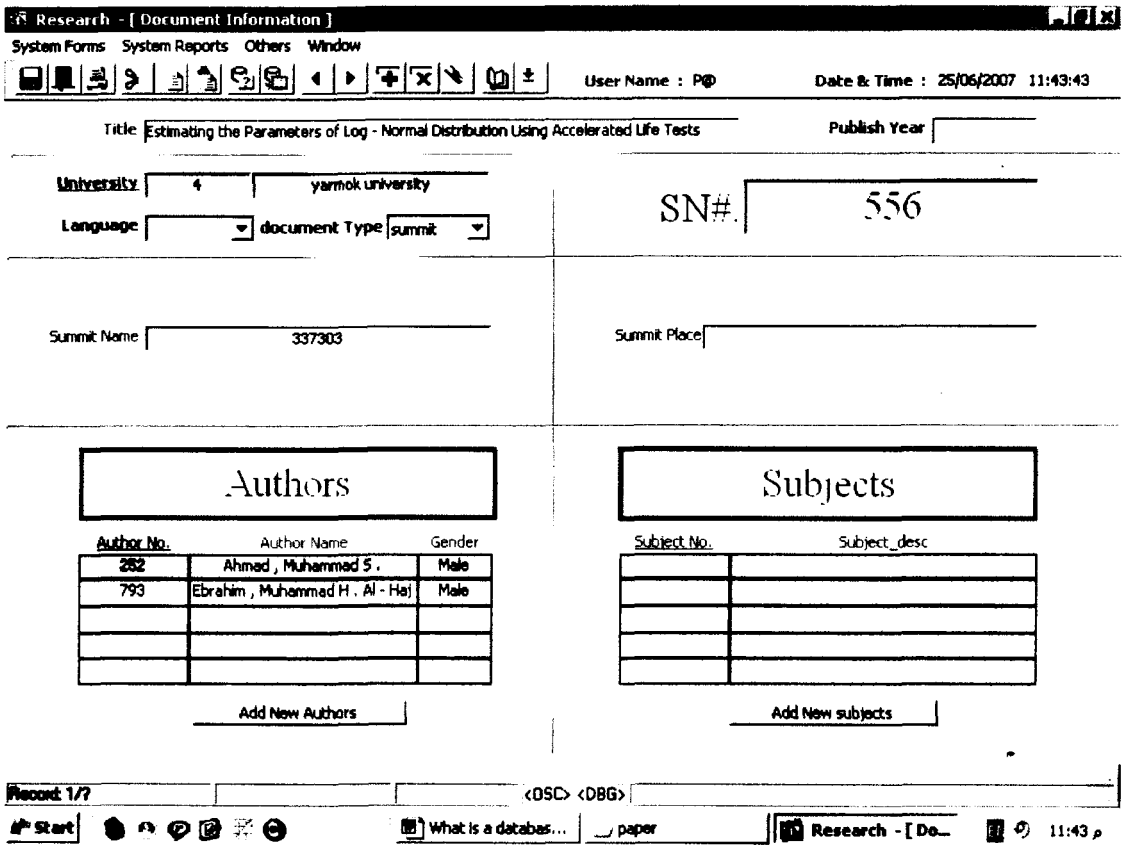
- SQL/PLUS.
- Oracle Form Builder.
- Oracle Report Builder.
- Oracle Graphics Builder.
- Oracle Designer.

The system contains three main forms as follows:-

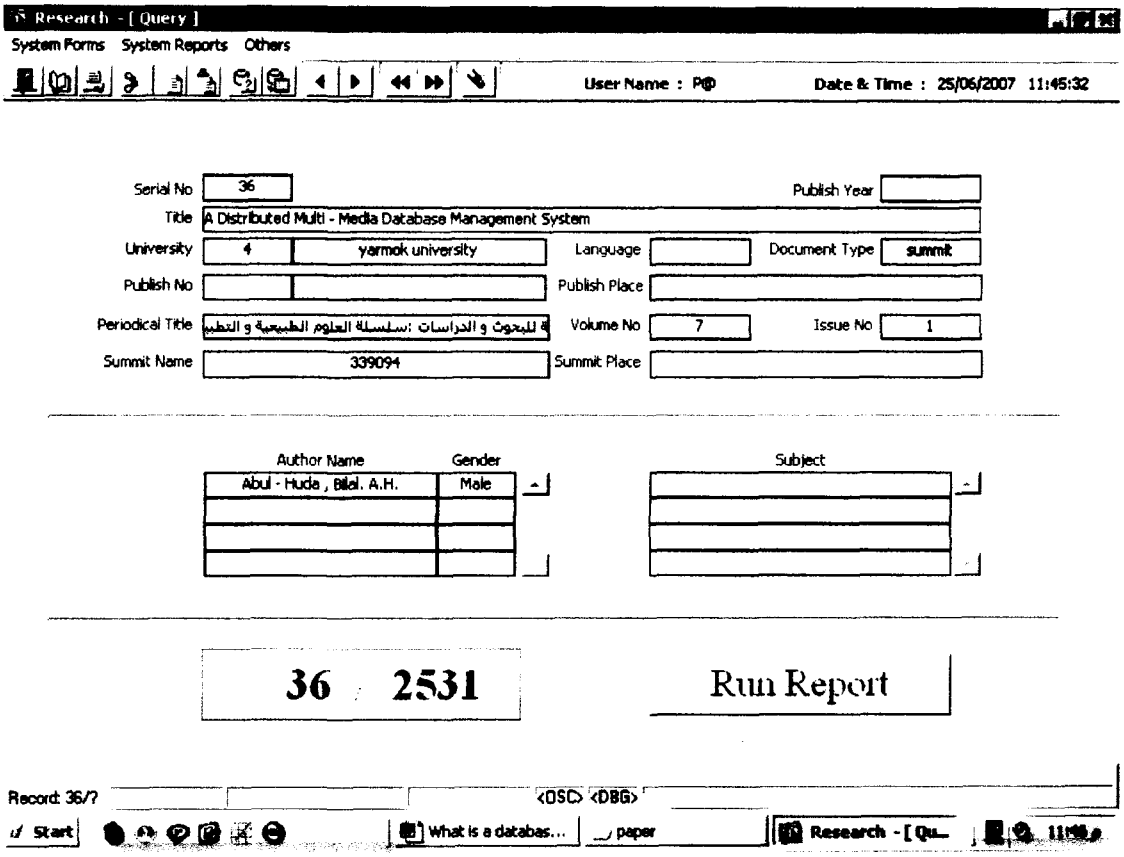
1- **System Variables:** It is used to define document type, languages, Universities.



2- **Document Information:** It is used to insert all information about the documents like title, year of publication, language, document type, authors, and subjects.



3. **Inquiry Form:** It is used to inquire about any field of information concerning the document, and can combine more than one fields, such as year of publication and language of document.



The Oracle database also contains many reports and statistics as follow:-

Research by author number,

Research by author gender,

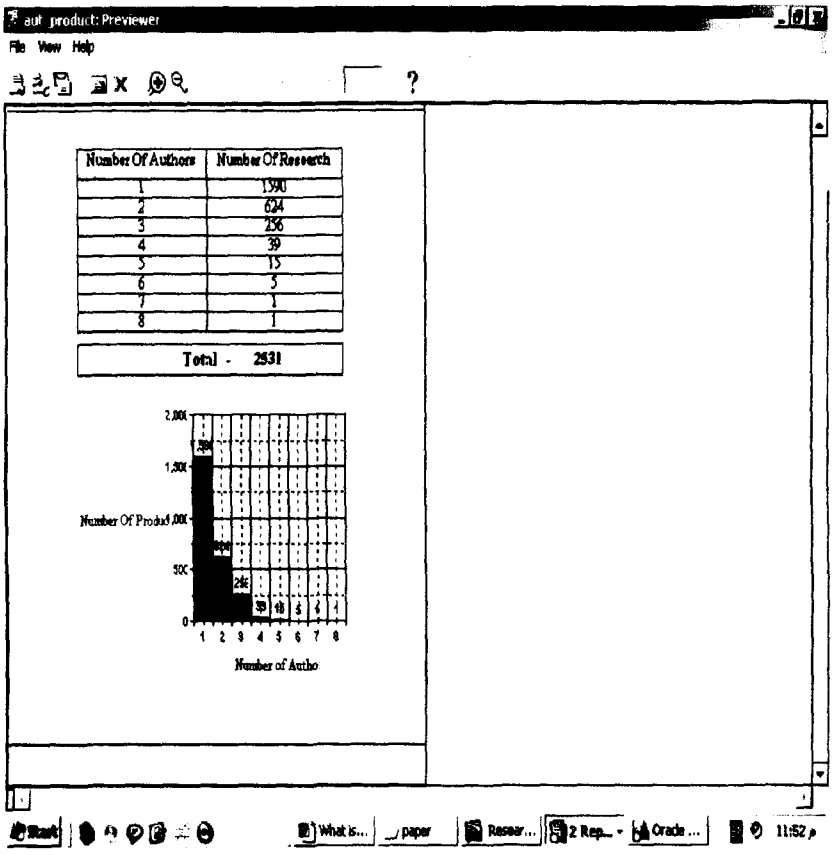
Number of research,

Authors' list,

Subjects' list,

Dynamic statistic report,

Dynamic general report, this report allows user to build his own report by choosing field and determining the condition of report.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2 624
3 256
4 39
5 15
6 5
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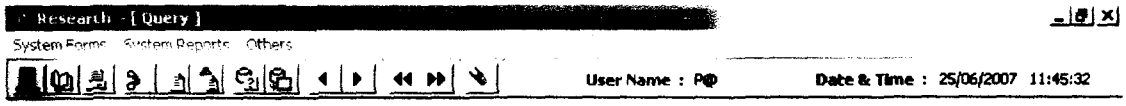
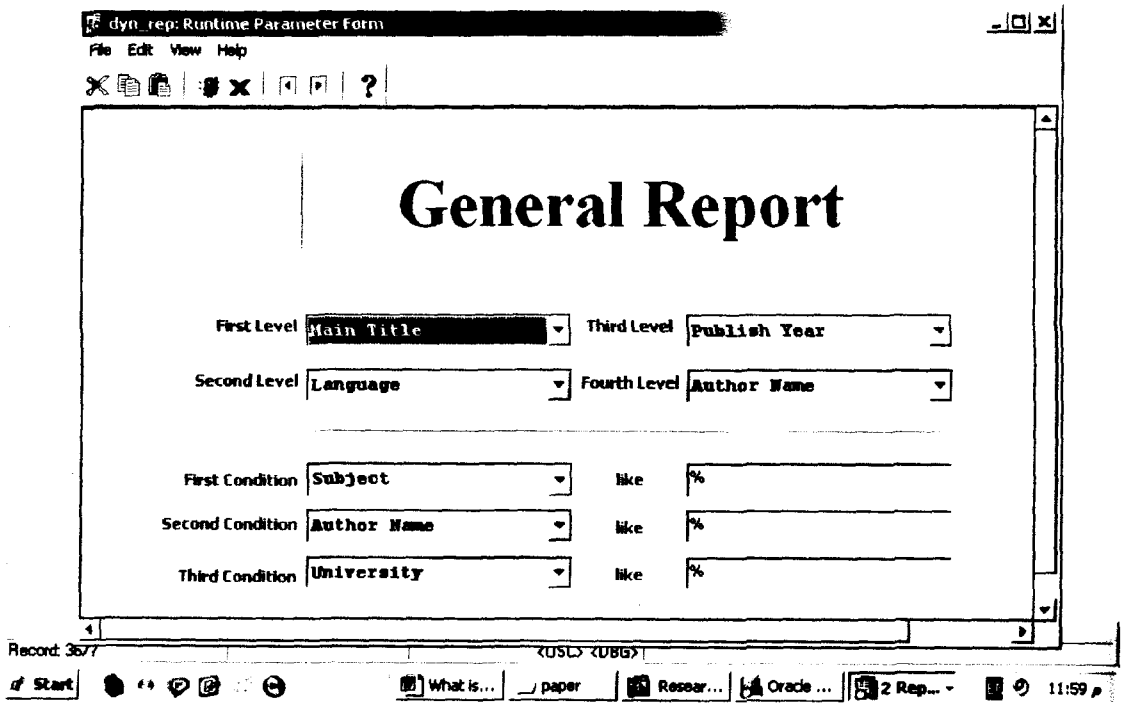

Research - [Query]
System Forms System Reports Others
User Name : P@
Date & Time : 25/06/2007 11:45:32


dyn_rep: Runtime Parameter Form
File Edit View Help
General Report
First Level
Main Title
Third Level
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Fourth Level
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Record: 3677
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11:59

Database Tables: - The Oracle can create tables with each and every field. For example-

- Languages
- universities
- Document Information
- Authors
- Document Authors
- Subjects
- Document Subjects

(E) Analysis

Next step is to tabulate and analyze data collected from various sources in order to conduct the following studies-

(i) RANKING OF PRIODICALS:

The main objective of this study is to identify the core periodicals (journals) containing the research "Publications in Sciences and Technology by Faculty Members in Universities of Jordan: A Scientometric Study". To conduct this study, the items published in different periodicals were grouped together and counted. It is necessary to know the most productive periodicals in Science &Technology.

(ii) GEOGRAPHICAL SCATTERING OF ITEMS:

This is done to determine the geographical scattering of items while studying the use pattern of research literature in the subject under study. The database clearly gives the place of origin of each item. The entries were grouped on the basis of their country of origin.

(iii) SUBJECT-WISE DISTRIBUTION:

This analysis has been done to know the scattering of "Publications in Sciences and Technology by Faculty Members in Universities of Jordan" in different subject fields. This analysis shows the interdisciplinary character of the subject field. The analysis has been done on the basis of information given in the field of periodicals publishing the literature.

(iv) LANGUAGE-WISE DISTRIBUTION OF ITEMS:

In this study an attempt has been made to analyse the language-wise distribution of items. Because the articles are published in almost all languages of the world, it is of paramount important to study language-wise distribution of items. This information is available in all standard Indexing and abstracting services. The same information has been used to know dominant languages of publications.

(v) CHRONOLOGICAL STUDY:

In this analysis time of origin of items was studied to know how many items belong to a particular time period on the basis of frequency of items belonging to a given year. The data was analyzed and tabulated to find out the most productive year of items.

(vi) FORM-WISE DISTRIBUTION:

These are varieties of forms of documents in which Publications in Sciences and Technology by Faculty Members in Universities of Jordan appear. There are articles, books, Articles in Conference Proceedings etc. the analysis has been done to know the major form of documents used for producing new information in the subject S&T.

(vii) RANKING OF AUTHORS:

This study has been conducted to know the eminent personalities (faculty members of Jordan Universities) in the field of Science &

Technology. Ranking of authors is done to identify the most productive contributions in the subject. For the purpose, the researcher arranged the entries in the A,B in alphabetical order by the surname of each author. All authors were thus retrieved, arranged and tabulated in the order of decreasing frequency of their contribution to know the most productive authors.

1.7 LIMITATIONS OF THE STUDY

This study is limited to the subjects that are related to Science and Technology such as Physics, Biology, Medicine, Pharmacy, as well as the Technical Fields and Engineering. The study will be conducted on the published output of the faculty members of aforesaid subject fields during the period from 1995 to 2005. The related books and published articles, only those published in English as well as Arabic Languages. Under the study, the scope of topic is limited to the followings government universities:

i. University of Jordan.

ii. Yarmouk University.

iii. Mu'tah University.

iv. The Jordan University of Science and Technology.

v. Al-Balqa Applied University.

vi. AL al-Bayt University.

vii. Al-Hashimiyah (The Hashemite) University

viii. Al-Hussain University.

ix. Al-Tafila Technical University.

x. The German-Jordanian University.

1.8 Data Analysis and Presentation

The data collected is analyzed and presented into tabular form. The main purpose behind it is to draw inferences and prove/disprove the hypothesis and fulfill the stated objectives of the study.

1.9 Chapterization:

The study comprises of eight chapters. Each chapter deals with different aspects of the research work, which is explained below:

Chapter 1: Introduction.

Chapter 2: Development in Science and Technology.

Chapter 3: Development of Higher Education in Jordan.

Chapter 4: Literature Reviews on Scientometrics.

Chapter 5: Scientometrics/Bibliometric Laws.

Chapter 6: Data Collection and Analysis.

Chapter 7: Application of Bibliometric Laws.

Chapter 8: Conclusion: Findings and Policy Recommendations.

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Chapter Two

Development of Science & technology

CHAPTER TWO

DEVELOPMENT OF SCIENCE AND TECHNOLOGY

2.1 INTRODUCTION:

Science and scientific research have obviously been growing at a faster rate during recent years. Every nation considers scientific and technical development as the basis for its overall progress. The manpower engaged in scientific research also shows considerable increase in recent years, as well as the number of institutions. One of the principal reasons behind policy makers and economists devoting considerable effort to the study of science and scientific plans is the positive impact and influence of Science and Technology on technological developments as the linking stage between science and economic growth. The idea that basic scientific research generates a technological impulse and subsequently, has direct positive effects on economic growth, corresponded originally with a hypothesis of linearity of the innovation process which arose from visible success of science in driving certain high technological activities in the developed countries in the second part of the last century, (Malecki, 1997).[1] Scientific and technological knowledge has expanded and advanced at an increasing pace since the end of the last century and the becalming of the armed global struggle with the end of World War II. The field of Science and Technology has witnessed a qualitative shift in the generation of information and knowledge and its investment that has led to significant changes in productive methods, in particular, and human lifestyle, in general. This has had a profound impact on the social and natural environment, (Higher Council for Science & Technology, 2004).[2]

The gap between the human capacity to invest scientific and technological expertise in meeting ever increasing demands and

safeguarding environmental and social balance has widened. With the end of the twentieth century comes the first implantation of the image of scientific and technological dependency, as the world has been divided into an advanced North and a backward South, separated by an area grouping the countries that attempt to follow the course of the end of the twentieth century in the affirmation of the reality of Science and Technology (S and T) as the major pillar of development in its different activities. Any developmental directive not taking this into account would remain abortive and ineffective in many of its facets.

2.2 SCIENCE & TECHNOLOGY: CONCEPTS AND DEFINITIONS

The civilization that is well- known today would have been impossible without science at least when its material aspects are concerned. Science, a human creation arises from the need to make sense of the world. It is a progressive activity that constitutes a worldview and permeates almost every aspect of modem life. The spread of scientific ideas has been a decisive factor in re-moulding the whole pattern of human thought. It is a systematic method of describing and controlling the material world. Today, we find in the conflicts and aspirations of our time a continual and growing involvement of science.

The march of events brings before us, ever more insistently, problems about science such as: the proper use of science in society, the militarization of science; the relations of science to governments' scientific secrecy, the freedom of science, its place in education and general culture. Whether for good or ill, its importance today needs no emphasizing. It is the means by which the whole of our civilization is rapidly being transformed. The pace of the growth of science is more rapid now than compared to the past. The term science is derived from a Latin word 'scientia' meaning 'knowledge'; this encompasses the knowledge of nature and universe.

2.2.1 Definitions of Science: Some standard definitions of the word "science" are given as follows:

1. (McGraw-Hill Dictionary of Science and Technology, 1983)[3] defines

   "Science is that branch of study in which facts are absorbed and classified and usually quantitative laws are formulated and verified, involves the application of mathematical reasoning and data analysis to natural phenomena".

2. (Merriam-Webster's Collegiate Dictionary, 2001)[4] define science as: "The state of knowing knowledge, as distinguished from ignorance or misunderstanding".

3. (The McGraw-Hill Encyclopedia of Science and Technology, 1997)[5] defines "Science is the study of nature and natural phenomena characterized by the possibility of making precise statements which are susceptible of some sort of check or proof".

4. (New Standard Encyclopedia, 1983)[6] defines: "Science is the systematic and unbiased study of the world, including everything that can be seen or detected in nature, man and society, and the knowledge that grows out of such study".

5. (Encyclopedic Dictionary of Art, Literature and Science, 1989)[7] defines: "Science is the study of truth, the common principles of which are supposed, to be known and separated so that the individual truths even though some or all may be clear in themselves, have a guarantee that they could have been discovered and known, either with certainty or with such probability as the subject admits of, by other means than their own evidence".

6. (Collier's Encyclopedia, 1987)[8] defines: "Science is a human creation, which arises from the need to make sense of the world. It is a progressive activity that constitutes a world view and permeates almost every aspect of modem life".

2.2.2 Definitions of Technology:

The term technology came into existence in the seventeenth century to describe a systematic study of the Arts. It seeks to find practical ways to use scientific discoveries profitably, ways of turning scientific language into utilitarian processes and devices. The history of technology can be said to be older than man himself, for the hominids that preceded Homo erectus and Homo sapiens were the first to use tools. It is the means to improve one's surroundings. Technology is the product of science and capital; it is also specialization and division of labour. It is the only way to solve economic scarcity. It has evolved from utilization of materials, exploitation and transformation of energy, understanding and application of scientific principles and information processing. The World is witnessing bewildering changes on account of the development of technology. It has a pervasive multifaceted and dynamic, impact on society and brings about tremendous changes. In recent years technological change has been so rapid that more than half the items produced in the United States today did not exist twenty years ago. It broadens the horizons for society to change its environment and enables it to use technological instruments for molding its own future. It also complicates society and its problems; with the result that finding the intellectual solution is extremely difficult. The word technology comes from a Greek term "Tekhnologia" meaning a systematic treatment. Some definitions of the term 'Technology' are as follows:

1. (McGraw-Hill Dictionary of Science and Technology,1983)[9] define: The term "Technology is a systematic knowledge and its

application to industrial process is closely related to engineering and science".

2. (Merriam-Webster's Collegiate Dictionary, 2001)[10] defines the word "Technology is a systematic treatment of an art, the practical application of knowledge especially in a particular area".

3. (New Webster's dictionary and Thesaurus, 1991)[11] defines: "Technology is a science of mechanical and industrial arts as contrasted with fine arts".

4. (New Standard Encyclopedia, 1983)[12] as: "The use of scientific knowledge to develop and produce goods and services useful to man is technology. It is sometimes called as "applied science".

5. (Macmillan's Science & Technology Encyclopedia, 1983)[13] defines "Systematic study of the methods and techniques employed in industry, research, agriculture and commerce".

6. (Concise Encyclopedia of Science and Technology, 1994)[14] define: "Technology is a systematic knowledge and action usually of industrial processes but applicable to any recurrent activity.

2.3 HISTORY OF SCIENCE AND TECHNOLOGY:

As a matter of fact, science has been shaped and reshaped over the years. An ancient civilization going back to more than five thousand years, which evolved with an amazing continuity, could not have been uninfluenced by science. Different civilizations played their important role in the development of various fields of science. Science, which was in primitive form then, made their lives comfortable.

2.3.1 Old Stone Age-Primitive:

Primitive life or the old-stone age had showed the mankind just as a food gatherer, thus led a nomadic life. But slowly he learnt better methods of getting food and protection than he could achieve while

staying in isolation. He learnt the use of tools. Through the use of tool making and tool using, men learned the mechanical properties of many natural products and thus laid basis of Physical Sciences. Tools made their hunting easier and shaping of materials of wood and stone. Man started using hides and skins of animals to cover himself and slowly learnt stitching of clothes. Fire was discovered accidentally which laid the basis of Chemical Science. He started taking cooked food. By the end of Old Stone Age, man started using clay pottery and used containers, which could hold liquids for longer duration without fermenting them. Rational chemistry thus came into being.

Primitive man keenly observed plants and animals' in his surroundings. He started thinking about nature and this gave rise to the biological sciences of today. He did posses some knowledge about art already and thus, probably, started drawing pictures mostly of caves and animals. Also some representations of human organs like those of heart and bones have been found, which laid the basis of Anatomy. By using implements he transformed nature, which gave rise to Mechanics. There were some medicine men or shamans who had concern with health.

2.3.2 New Stone Age

The new Stone Age era came between the first invention of Agriculture and the foundation of cities that period was usually known as New Stone Age of Neolithic age. During this age, ground and polished stone implements were used in place of chipped instruments of the Old Stone Age. It lasted for approximately 8000-3000 B.C. There began a revolution in food production. The difficulties that man faced in searching food led to the invention of techniques of Agriculture, New techniques in Agriculture was introduced which gave rise to new mathematical and mechanical concepts.

As we know, most of the civilizations originated from river valleys, where cultivation by natural flow irrigation canals could be practiced. Early civilizations were accordingly, limited to a number of favoured areas, the main ones known to us being those of Mesopotamia, Egypt and of the Indus valley. The major technical advancements that took place were the discovery and use of metals like Copper & Bronze. The lever and inclined plane, used in great constructions of temples and pyramids strengthened the foundation of Mechanics. The transport by cart and ship were known sources of valuable materials, led, to the deliberate exploration and to the beginning of Geography. Then raised the consciousness among the people to keep records, they started using some signs/symbols and thus came Mesopotamian Cuneiform or Egyptian hieroglyphics into existence. The final simplification of true alphabet did not occur till Iron Age. Mathematics came even before writing. First they used ten fingers of two hands for counting. For complicated counting, stones were used. Then they replaced it by beads arranged on wires-Abacus.

The practice of building gave rise to Geometry and also to conceptions of areas and volumes of figures. The calculation of volume of pyramid was highest flight of Egyptian Mathematics. Early civilizations like those of Sumerians and Mesopotamians paid lot of attention to sun, moon, and stars and regular phenomenon of day and night which gave rise to Astronomy. They tackled the difficult task of reconciling the lunar and solar calendars. The Egyptians thought sky as a flat cover, resting on hills. The Babylonians pictured it as a vast four square tent. Chinese Astronomy started with the idea of rotation of a wheel. Medicine was considered as an upper caste profession. The doctor could only deal with wounds, dislocations, and fractures and tried to save patient's life. The South American Indians had discovered Quinine for curing malaria. This gave rise to the science of Botany. During Bronze Age and till the end of Iron Age, Chemistry never rose to

the rank of a recognized science. The technical innovation that came with the beginning of city life of river valleys of Mesopotamia, Egypt, India and China did not last for more than a few centuries. It was followed by cultural and political stagnation. There were eruptions of barbarians and even barbarian dynasties. The successors of original administrators, who improved agricultural techniques before, turned exploiters. The virtual enslavement of peasants and urban craftsmen, led to the conflicts and thus city-states got weakened and ultimately put a stop to their intellectual and technical progress.

2.3.3 The Iron Age

The Iron Age had started from the middle of the 2nd millennium BC some technical political and, economic factors brought transformation of the civilizations of few river basins into which embraced the major cultivable areas of Asia; North Africa and Europe. The Iron Age improved tools and machines but did not make remarkable change in material technique. The advances it made were more widespread among the social classes. During this period, the Greeks assembled and developed out of the technical experience of the older empires.

2.3.3.1 The Greeks

Their era was the most successful in the exploitation of the new conditions of the Iron Age were the Greeks. Almost unconsciously and without acknowledgement, the Greeks took most part of the learning, which is still available, centuries after the destructive warfare. Greek science was of different character from that of early civilizations. The Greeks esteemed most Mathematics, especially Geometry. The technical developments in early Iron Age and especially by Greeks before Alexandrian period were not as fundamental as those of Bronze Age. Of the chemical inventions the most important was that of blown glass first made in Egypt. Metal using technique started in 6th century

B.C. Architecture in Greek times advanced to the level of citizens' profession. Greek science developed in a more general and independent way but lacked experience.

The history of Greek science underwent through four phases- Ionian, Athenian, Alexandrian or Hellenistic and Roman phases. Greek science is believed to originate in the Ionian cities of Asia Minor in 6^{th} century B.C. It is associated with the legendary figures of Tales and Pythagoras. Tales is believed to have predicted the solar eclipse in 585 B.C. and invented formal study of Geometry. Hellenic science based on Tales and Pythagoras reached its zenith by the works of Aristotle and Archimedes. Aristotle made his framework in Biological Sciences while Archimedes made greatest contribution in Mathematical Physics.

The Greeks made great progress in the field of medicine. Pre-Greek medicine was entirely confined to religion and ritual. Hippocrates and his school insisted that disease was natural and not supernatural. In the museum of Alexandria a research institute was set where various human organs like heart, brain etc were investigated. These researches led the base for Physiology. But medical practice remained eclectic and a matter of physician's choice.

2.3.3.2 Science in Rome and Christianity

Science in Rome during the Christianity era was inherited and established on the background of the rise of Greek science that coincided with that of Roman power in the Mediterranean. Science and Philosophy under Romans was -either ignored or relegated to rather low status. The spirit of independent research was quite foreign to the Romans, so scientific innovation grounded to a halt. The scientific legacy of Greece was condensed and corrupted into Roman Encyclopedias. One religious sect, which proved more significant than the rest, was Christianity. The early Christians approached the worldly

wisdom of their time. The lamp of ancient learning was burning very feebly even after the fall of Roman Empire.

2.3.3.3 Science and Technology in Islam

The Arab, in the seventh century, were inspired by their new religion (the Islam) have had burst out of their Peninsula and laid foundations of an Islamic state, which eventually rivaled that of ancient Rome. To the Arabs, ancient science was a precious treasure. Al-Quran, the sacred book of Islam, praised medicine as an art close to almighty Allah. Astronomy and Astrology were believed to be one way of glimpsing what God willed for mankind. And contact with Hindu Mathematics and the requirements of Astronomy stimulated study of numbers and of geometry. The writings of Hellenes were thus, eagerly sought and translated and thus much of the science of antiquity passed into Islamic culture. Greek Medicine, Astronomy, Astrology, Mathematics, and works of Plato and Aristotle, were assimilated in Islam by the end of 9th century. The numbers fascinated Islamic thinkers, which gave rise to Algebra.

During the darkest of Christian, that is, the ninth and the tenth centuries, confident, expansive Islamic state preserved and extended much of classical knowledge 'enlightened' caliphs have had patronized art and science and they encouraged the translation of classical literature. For the most part Muslim intellectuals were free to explore wide horizons and made inventions and discoveries unimagined in Christendom. Without the contribution of the Islamic world there would have been no European Renaissance; without Islamic Science and Technology the new world would not have been discovered.

(i) Chemistry, Mineralogy, Gemology:

In the 8th century Iranian Jabir ibn Hayyan of Kufa (721-815) ('Geber' in Europe) transformed alchemy from occultist art into a

scientific discipline - thus earning his reputation as the 'father of chemistry'. Jabir was active both at the royal council in Baghdad and at his laboratory in Damascus. He wrote over a hundred treatises (notably, 'Summa Perfection's) describing distillation, crystallization, calcination, sublimation and evaporation. He also wrote works on medicine and astronomy. Among his many achievements was the distillation of vinegar into acetic acid followed by nitric, hydrochloric, and citric and tartaric acids. He went on to combine hydrochloric and nitric acid to produce aqua regia a highly corrosive acid used to extract and purify gold (a much-valued skill). His insight led to improvements in rust prevention tanning, water-proofing, and the manufacture of steel and glass. Jabir's pioneering methods in the study of chemical reactions anticipating by almost a thousand years the principle: of quantitative chemistry and the law constant proportions. His work provides the standard texts for European alchemists for centuries. As early as the 10th century, Muslim physicians and surgeons were applying purified alcohol to wounds as an antiseptic agent. Five hundred years after Jabir's death, the Spanish alchemist Arnau de Villanova used his distillation process to produce brandy and whisky. In 1310 sulphuric acid followed. Another Muslim scholar, namely, Abu Rayhan al-Biruni (973 -1048) speculated that the Indus valley was an ancient sea basin filled up with alluvials. He explained artesian well and natural springs by the principles of hydrostatics. He also calculated to be within 10 miles radius of the earth. And also another one Ahmad Ibn Yusuf al-Tifashi (l253) an Egyptian who wrote the work 'Flowers of Knowledge of Precious Stones' on the medicinal and magical uses of gems, and minerals.

(ii) Medicine, Pharmacology and Botany

The first public pharmacy opened in Baghdad in the year 750, and in the 800 al-Batriq translates the works of the second century

Greek Galen into Arabic. In the tenth century, al-Razi used mercurial compounds as topical antiseptics, described the function of the veins and their valves. He writes critiques of Galen. Muslim chemists, pharmacists and physicians produced thousands of drugs and/or crude herbal extracts. In the 14th century Ibn Baytar writes a monumental pharmacopoeia some 1400 different drugs. Ibn al-Zuhr correctly described the nature of pleurisy, tuberculosis and pericarditis. Az-Zahrawi (d.1013), accurately documented the pathology hydrocephalus (water on the brain) and other congenital diseases and performed hundreds of surgeries under inhalation anaesthesia with the use of narcotic-soaked sponges. Ibn al-Quff and Ibn an-Nafs described the diseases of circulation.

Abu Rayhan al-Biruni (973 -1048), the Persian polymath, in the train of Sultan Mahmood Ghaznavi, the conqueror of India, writes the Kitab-al-Saidana, an extensive compendium of Arab and Indian medicine. He describes vario 'monstrosities', including 'Siamese' twins. He also writes the first scientific work of comparative religion Kitab al-Hind (India). From the 9th - 15th century, the Medical School of Salernum (Salerno), Italy, reestablishes in Europe the medical science of antiquity that had been preserved and refined by the Muslims after the fall of Alexandria. By the end of the 13th century there are flourishing medical schools at Montpellier, Paris, Bologna and Padua and, as a result of contact with the Arab world, the first apothecary in Europe in Florence.

The Persian/Turkish Ibn Sina (979-1037) (aka 'Avicenna') produces a compilation of Hippocrates and Galen. His major work is an encyclopedic compilation of ancient medical wisdon which forms the curriculum of European medical schools until the 17th century. As an alchemist Ibn-Sina improved distillation process and (essential oils) that were used extensively later. The 13th-century Arab physician al-

Samarqandi writes on aromatic bath aromatic salves and powders. For sini or ear congestion he suggests steams vapours, and incenses of marjoram, thyme, wormwood, chamomile, fenne mint, hyssop and dill and the burning herbs in a gourd.

By the end of the 9th century, Abbasid administrators had amassed a great deal of information on their vast state. Official reports were mixed with geographies, travellers journals and tales of natural marvels. Historical interpretation thus became possible. Historical writing began with accounts of life of the Prophet. Regard to 'authoritative' sources (isnad) rather than creative embellishment provided measure of accuracy. Al-Idrisi, in 12th century Sicily, was commissioned to compile the 'Book of Roger' for the Norman King of Palern-ii with accompanying maps. 13th century Yaqut wrote a large geographical dictionary, compiled from many sources. Ibn Khaldun, a Tunisian government official, who served at Andalusia courts all the way from Granada to Egypt 15th century, established a new standard of historiography with his great work 'Muqacldimah,' in which he noted sociological and natural influences-climate, social customs, food, superstitions - as well as rulers and battles.

(iii) Architecture:

A repertoire of columns, capitals, different shaped arches, ribbed cupolas and mosaics characterized a very distinctive Islamic architecture. **Garden Cities:** Arab architects combined buildings, plants and fountains with great finesse. In a style echoing a Roman villa or toy house, living areas were grouped around and opened onto a central courtyard; high walls shut out the outside. Gardens to Islam were a mirror of Paradise. Patio entered English from the Spanish, the concept of an inner court open to the sky developed by the Moors. Azure (from Persian /Arabic 'al 'lazward). Hence "N 'lapis lazuli" - blue stone - much favoured on Islamic buildings. Oddly, also echoed in the word

dilapidate (which originally had the meaning 'squander' - i.e. the exuberance of Islamic design). 860 Brothers Muhammad, Ahmad a Hasan Ibn Shakir wrote 'Book of Artifices', earliest extant treatise on mechanics. 1095 -1138 Ibn Bajja (aka 'Avempace'), a native of Saragossa, Spain, wrote commentary on Aristotle concepts of Motion Clocks. During the 9th century, Ibn Firnas inSpain, invented a watch-like device which kept accurate time. The pendulum was discovered by Ibn Yunus al-Masri during the 10th century. He was the first to study and document oscillatory motion. A variety of weight-driven, mechanical clocks were produced in Moorish Spaii both large and small. Designs include! Epicyclical and segmental gears, and even a mercury escapement. This knowledge was transmitted to Europe through Latin translations of Islamic books on mechanics during the 15th century.

(iv) Glass Mirrors:

Glass mirrors were in use in Islamic Spain as early as the 11th century. Tl-Venetians, also proficient in fine glass production, learned the art from Syria artisans during the 9th and 10th centuries.

(v) Law:

Eighth century Abu Hanifa and Anas Ibn Malik established the first Islamic law schools ('Hanafi', 'Malaki'). In the 9th century a more liberal 'Sha law school was established by Idris al-Shafi and a more severe 'Hanbali' school was founded by Ahmad ibn Hanbal follows. Since Islam draws no distinction between religious and secular life, Sharia law covers both the observance of religious practice and day-to-day life. As-Sharia is held to be divine it can never be altered but only obeyed. In contrast, not until the 12th century did Europeans have Law at all when Roman's Law (preserved in a fashion at Constantinople) was rediscovered and used to establish a harsh jurisprudence. (Abed Alrahman, Hekmat Najeb,1977)[15].

2.3.4 Medieval Science

The medieval age showed little scientific investigations undertaken almost exclusively for religious ends by clerics, priests and monks. The men of Middle Ages were perfectly competent in reasoning and in design and carrying out experiments. But their experiments remained isolated. The sum total of the medieval achievements in natural sciences include a few notes on natural history and minerals by St. Albert.

Mathematics during medieval age did not make any serious advancement till Renaissance. In Astronomy Ptolemy's 'Almagest' was translated from Arabic. In observational Astronomy, the science where accurate observation, calculation and prediction were necessary, Islamic predominance lasted longer than in any other branch of science. The medieval astronomers showed themselves capable of making some improvements in detail in astronomical calculations. They also made contributions to Trigonometry and construction of instruments. Architecture was the greatest and most characteristic expression of medieval technique and thought. Medieval architecture contributed little, directly or indirectly, to the advancement of science.

2.3.4.1 Technical advances from the East and China

The technical advances of middle Ages were made possible by exploitation and development of inventions, which were to give Europeans greater powers of controlling and understanding the world. The major inventions like clocks, compass, etc. have come from the East and most of them ultimately from China. Many inventions appearing in 10th century or later in Europe were fully described in China in the 1st century.

The two technical introductions from the East, which were fated to have a far greater effect in the West than in their land of origin, were the

linked inventions of paper and printing. The process of papermaking was originally developed in China. It was introduced to Europe via the Arabs in the 12th century. Printing with movable wooden type was originally a Chinese invention of the 11th century. The Koreans first used movable metal types in the 14th century. It was introduced into Europe in the mid 15th century. Later still, largely in the 16th century, printing was to be the medium for great technical and scientific changes.

2.3.5 Rise of Modern Science

The careful observation of nature, increasing familiarity with mechanical representations of the heavens and attempts to represent natural events mathematically, were ingredients in the rise of modem science whose roots are found in Middle Ages. The rediscovery of Hennetic Corpus of writings on natural magic encouraged the study of nature and the printing press that made possible the growth of science as public knowledge. During' 16th and 17th century people were not able to make distinction between science and its applications. The printing press was part of new technologies and science became an instrument of national power and progress for most of the European nations, which induced change rapidly. These changes were evident in Astronomy followed by Mathematics, Physics, Biology, Chemistry, etc. Some of the scientists who did outstanding work in various fields of Science were Copernicus, Kepler, Galileo, Robert Boyle, William Harvey, and Lavoisier.

In the nineteenth century an unprecedented development of science took place, there were few opportunities for education and careers in sciences. Science and industry began to find common ground and make common cause. Science became a growing force for change in the material and intellectual climate of the 19th century. Eminent scientists of this century were Faraday, Joule, Ampere,

Thomas Young, and Charles Darwin, all of them and many others contributed to the various inventions. The twentieth century saw even more rapid and extensive advances in science than its predecessor. Many subjects like Physics; Chemistry, and others, revolutionized more then once since the turn of the century. An enormous output of agrochemicals boosted the crop yield. Organic chemistry tackled the synthesis of vital molecules like hemoglobin and structural Organic chemistry, in breaking the code of deoxyribonucleic acid (DNA), paved way to understand the chemical basis of inheritance. Organic chemistry merged with new sciences of Molecular Biology and Biochemistry.

Laser Spectroscopy made it possible to study the chemical processes occurring in less than billionth of a second. Physics also experienced a great revolution. Einstein's 'relativity theory' made an end to Newtonian Physics. The structure of matter and particles of matter had profound implications for cosmology and nuclear power. The radio telescopes, orbiting laboratories, and lunar and planetary probes transformed Astronomy and Cosmology beyond recognition. In 1970's man landed on moon, and unmanned landings were made on Mars and Venus. The Voyager spacecraft revealed more clear pictures of planets and recognized the rings around Saturn more distinctly. The X-ray astronomy and gamma-ray astronomy unfolded the life histories of stars.

In the subject of Biology, advancement occurred in evolutionary theory. Artificial selection transformed agriculture more rapidly than before Darwin's theory on natural selection and Gregor Mendel's inherited characteristics produced understanding of inheritance and' Molecular Biology unlocked the genetic code. In 1980's the first mammals were cloned. In medicine the development of penicillin and sulfonamides, discovery of vaccines for polio and smallpox and other

similar advances helped in making progress in health. By 1970's small pox was internationally eradicated.

The invention of the analytical engine by Charles Babbage in 1833 brought a revolution in the electronic media. After over a century in 1937 the first mechanical computer Mark-I was developed by Howard Aiken in which transistors were used and which reduced the physical size and increased speed of the computers. Since then measurable developments have taken place in the field of Information Technology that ultimately increased the capability for sharing information, knowledge an experience without physical proximity through networks. It has enhanced the perceptual and physical understanding of the whole world. Hence, the information technology revolutionized the working environment across he globe. Science played a greater role victory of the wars, especially during 1950's the horror of atomic weapons and threat of chemical and bacteriological warfare, changed attitudes. Deforestation and growth of agriculture has caused imbalance of the atmosphere. Acid rain, formed due to industrial pollution became a concerning issue. Such developments rose to the need for greater public understanding of science.

2.4 History of Science and Technology in Jordan

The Jordanian national Science and Technology policy is focused on developing information management resources, creating technologically proficient and globally competitive human resources, building research and development capabilities, and enhancing the transfer and adaptation of modern technologies. The Jordanian workforce is among the most skilled in the west Asia region. Jordan boasts an 87.5 per cent literacy rate with more than seventeen per cent of the population pursuing higher education. Applied research and development activity in Jordan is still modest, both quantitatively and qualitatively. Much of the research and development effort is focused on

basic or academic research. National expenditure on research and development is still at a relatively low level, at best not exceeding 0.35 percent of the gross national income.

In the early 1970s, the Royal Scientific Society (RSS) was established as the first national scientific research center with a mandate to intensify national efforts in building research and development capacities, expand industrialization and facilitate public and private sector access to Science and Technology. Domestic and international circumstances and limited resources have prevented Jordan from generating much of its own technology to serve national goals. Instead, Jordan has placed emphasis on transferring, adopting, and harnessing technology developed elsewhere.

In mid-2000, the Government of Jordan announced that strengthening the information technology sector was a national priority. A national strategy for information technology development, known as the REACH Initiative, was developed by Jordanian public and private sector entities. The overall goals of the initiative include developing an internationally competitive IT industry that will attract international and local investment, generate high-value jobs and produce substantial levels of exports in the near to medium term. Jordanian authorities recognize that implementing the strategy will require modernization of both the public and private sectors. These goals, to be achieved by the year 2004, seek to create 30,000 information technology related jobs, generate $550 million in exports and attract $150 million in cumulative foreign direct investment.

By the late 2000, Jordan made significant progress toward achieving the goals of the national IT development initiative. The local telecommunications monopoly was privatized and Jordan developed a positive reputation for stringently enforcing intellectual property rights. The Ministry of Post and Telecommunications is striving to make major

changes to government legislation that will be conducive to e-commerce, e-banking, cyber security and privacy. There is no doubt that Science and Technology, if properly harnessed, are optimal tools to enhance Jordanian capacity in all fields of comprehensive development, in coordination between the different sectors involved. The related Science and Technology activities include major components such as research and development, Science and Technology services; and training and education. The Higher Council for Science and Technology its affiliated centers, and national research and technology networks endeavor to strengthen national capacity and potential in these three fields so as to best serve developmental sectors. The HCST annually offers financial aid in support of research and development projects undertaken by various national institutions in areas of development priorities. Such support is part of the HCST annual budget for research and technology, and additional support goes out through the national research and technology networks, Industrial Scientific Research and Development Fund (ISRDF), and the National Fund for Enterprises Support (NAFES) that are all affiliated to the HCST. The HCST also supports its affiliated centers to enhance their capacity to offer specialized Science and Technology services to fulfill the requirements of the various economic sectors. Further efforts are undertaken to enhance the qualifications of, or train, those engaged in research and technology through research projects supported by the council and financial contributions for the organization of scientific conferences and workshops.

2.4.1 Historical Policy and Institutional Developments

Prior to the year 1987, the Science and Technology in Jordan was taken care of by the Department of Science and Technology at the National Planning Council (Now Ministry of Planning and International cooperation). In affirmation of the vital role of Science and Technology

in the sustainable development of various economic sectors, it was decided to institutionalize Science and Technology activities under a national umbrella that would set Science and Technology policy, strategies, plans and programs. A national committee was established, around twenty years ago, and entrusted with a task to develop a framework for a national organization that would cater for Science and Technology activities in Jordan. To this end the Higher Council for Science and Technology was established in 1987 to build a national Science and Technology base to contribute to the achievement of national developmental objectives, through increasing awareness of the significance of scientific research and development by providing the necessary funding for such activity and directing research and development activity towards developmental priorities. The Council was also entrusted with the establishment of specialized centers for research and development activity, where appropriate, and represents the Kingdom at regional and international Science and Technology activities.

The Higher Council is presided over by HRH Prince al-Hassan bin Talal, who has been instrumental to the progress of Science and Technology in Jordan from the very beginning. Under the chairmanship of HRH, the Council is made up of the following:

- The Minister of Finance.
- The Minister of Planning
- The Minister of Higher Education and Scientific Research
- The Minister of Telecommunications and Information Technology
- The Minister of Energy and Mineral Resources
- The Minister of Industry and Trade
- The Minister of Education
- The Minister of Agriculture
- The Commander-in-Chief of the Jordanian Armed Forces
- The President of the Royal Scientific Society

- The President of Amman Chamber of Industry
- The President of Amman Chamber of Commerce
- The Secretary General
- Three persons of qualification and experience to be appointed by the Chairman for two-year term which is renewable.

The HCST exercises the following main responsibilities in realization of the objectives for which it was founded:

- Ratifying the general policy of Science and Technology in the Kingdom,
- Defining its priorities, and
- Drawing up the related programs and plans as well as following up on their implementation and evaluation,
- Drawing up the strategies suitable for the development of scientific and technological potential in the Kingdom and providing the scientific environment suitable for this purpose.
- Supporting the institutions and units of scientific and technological research and providing the necessary funding for the support of scientific and technological research as well as scientific and technological services and activities in the kingdom.
- Participating in the supply and training of manpower and technical potential for scientific and technological research institutions.
- Undertaking scientific and technological cooperation and concluding agreements related to scientific and technological research in collaboration with local, Arab, regional and international organizations.

The Council may establish affiliated specialized centers of Scientific and Technological research. The General Secretariat of the Higher Council for Science and Technology follows up on developmental fields including:

Industry and Mineral Resources,

Agriculture and Water,

The Environment,

Infrastructure, and

Developmental cooperation.

This is undertaken in accordance with the decisions taken by the Higher Council as related to all fields of Science and Technology activity. The General Secretariat also follows up on the implementation and coordination of the activities that assist in enhancing the endeavors of various economic sectors from the scientific and technological angle. Such activities are usually undertaken at the initiative of the Higher Council and its General Secretariat or through the financial support of international institutions. The Jordanian Government provides the Higher Council with an independent budget through which the council supports research and development projects and programs. This includes activities that contribute to strengthening channels of communication and increasing coordination and cooperation between various national institutions, thereby providing the basis for enhancing the role of S&T within comprehensive development.

2.4.2 Contemporary Institutional Landscape

There are around 681 institutions that deal with Science and Technology activities in Jordan, out of which 16.4 per cent are belonging to public, and 79.9 per cent are private sector. The HCST is among the public institutions and it has seven affiliated research centres

and networks. The relationship of HCST with other national institution falls under one of the following categories:

(i) The Ministry of Higher Education and Scientific Research

(ii) The Ministry of Industry and Trade

(iii) Universities are University of Jordan, al-Balqa Applied University, and Jordan University for Science and Technology.

(iv) HCST Affiliated Centers

(v) National Center for Human Resources Development

(vi) National Center for Diabetes, Endocrine and Inherited Diseases

(vii) National Energy Research Center

(viii) Jordan Center for Public Policy Research and Dialogue

(ix) National Virtual Center for Biotechnology

(x) Jordan Badia Research and Development Center

(xi) National Network for Advanced Materials and Nanotechnology

(xii) Science and Technology Resources Development Department

2.4.3 Role of Donors and International Organizations

The HCST has signed several Science and Technology cooperation agreements and Memorandum of Understandings (MoUs) with several countries and agencies. This also applies for other national institutions particularly universities and research centers. The parties which the HCST is cooperating with include the EU, the USA, the UK, Germany, Tunisia, Pakistan, and ESCWA countries.

One of the most vital cooperation endeavors is that with the German Research Society (DFG). It covers a wide range of activities including joint research projects, research and consultancy visits, and

joint specialized seminars. This cooperation is expected to expand and to cover sabbatical leaves of university professors, visiting German professors to Jordanian university. So far more than 70 Jordanian and German researchers have benefited from this cooperation. Generally speaking the Science and Technology cooperation of HCST with others help in building the capacity of Jordanian researchers in their fields of expertise, and making available some financing needed for implementing research projects, enhancing the research facilities, and probably improving the research quality. Jordan is expected to sign an S&T association agreement with the EU by the end of this year. Once this happens it might influence the Jordanian S&T strategy.

2.4.4 Jordan National R & D Policy

The objectives of the Higher Council for Science and Technology included the ratification of the National Science and Technology Policy for the Kingdom, defining its priorities, establishing the related programs and plans and following up on their implementation and evaluation. This policy harvests a major national initiative, contributed to by a large cross section of institutions and individuals from the Jordanian S&T community. Their involvement took place through the work of consultative sectorial committees made up of delegates from ministries and other governmental institutions alongside representatives from the private sector, universities and scientific research centers. Those who prepared this document took the specific nature of Jordan into account and were in close contact with those involved in Jordanian development and aware of similar experiences in a number of countries worldwide. The policy was in accordance with the direction of Jordanian developmental Plans, and its definitions of target sectors for national Science and Technology policy and related strategies.

The National Science and Technology Policy met with national consensus through its review during the second Jordanian Science

Week convened in 1994. On this basis, the Higher Council for Science and Technology ratified the policy at the onset of 1995. The National Science and Technology Policy, which is under constant review and updating by the Council, formed the basis for executive programs for each of its four main elements, defined as: (i) Information Technology (ii) Human Resources Development (iii) Transfer of Technology; and (iv) Research and Development (R and D). These were circulated among institutions of the Jordanian Science and Technology community. The policy document and the related executive programs are used as part of the basis for HCST support of Science and Technology projects. These goals are to be activated through implementation of eleven national programmers in different fields of Science and Technology. In the strategy it is made clear that the HCST will focus, during 2005-2010 on new areas of research and development and those are: (i) Advanced materials and Nanotechnology (ii) Biotechnology, and (iii) ICT. The main driver for this focus is that the HCST believes that the basic capabilities for conducting these types of research are available and that we should therefore follow steps instead of staying behind. This would entail close and strong cooperation with relevant international institutions.

2.4.5 Future Visions/Foresights

In 2003 the HCST completed a three years project on "Jordanian Scenarios 2020". The project focused, in its first stage, on five major topics: Natural resources, Human resources, Economy, Social science, and Culture. A SWAT analysis was conducted on each of these fields. Parallel to this effort a population forecasting (2000-2020) exercise was also conducted. All of these formed the basis for the formulation of the three scenarios. The second stage of the project focused on the formulation of the scenarios, which took into consideration the domestic driving forces, which included the population, education, technology, political parties, religion, media, and social structure. At the international

level the driving forces included political allies, technology revolution (IT, and biotechnology), and environmental concerns. Three scenarios were formulated namely, the reference scenario, developmental scenario, and innovative scenario. The output of this project did not have a direct impact on the direction of the Science and Technology / Research and Development policy.

2.4.6 Research and Development Funding: Sources, Levels and Allocation Mechanisms

The Higher Council offers financial support to research and development projects on an annual basis. These are carefully chosen in accordance with national research and development priorities (general priorities that cover a wide range of research fields across the board) and implemented by researchers from Jordanian scientific institutions with the broad participation of higher education students. These projects were financed on competitive basis. Exceptionally and during (1996-2000) HCST launched a national research plan which focused on earth resources (energy, water, environment, and mineral resources), a block grant was allocated for this plan; another national productive research plan was approved for the period (2004-2006) which focuses on oil shale, geothermal, polymers, medicinal plants, and biotechnology. A block grant was allocated for this plan too. On average the annual R&D spending of the HCST is equivalent to around $US 300 thousands, all comes from the government through the HCST budget. At the national level the spending of R&D as a percentage of GDP does not exceed 0.4% and it increases to around 0.48% if the foreign financing is included. The following table 2.1 shows the R&D spending according to sources of funding in 2002 (No other table has yet been officially given after that year).

Table 2.1: R and D Expenditure According to Sources to Funding in 2002

Source	Budget	($M) %
Public	3.9	42.6
Private	9.0	27.8
Foreign	9.6	29.6
Total	32.5	100.0

2.4.7 Human and Infrastructure Resources

A survey conducted by HCST revealed that scientists represent around 25 per cent of total employees working in Science and Technology; engineers represent around 12 per cent. The survey also revealed that there are 19.6 scientists per 10,000 population, and 9.4 engineers. The total Full Time Equivalent (FTE) of researchers (Engineers & Scientists) working in Science and Technology units is around 25.5 per 10,000 population. The total FTE researchers (Engineers and Scientists) working in Science and Technology units is around 12.2 per 1000 work force. As for the qualifications of these researchers around 30 per cent of them have Doctorate Degree, 15 per cent have Masters Degree. 2 per cent higher diploma and 53 per cent have Bachelor Degree. Research training in Jordan takes various different forms. It is carried out through: (i) Research projects sponsored by HCST (ii) Research projects and research visits sponsored by foreign bodies (iii) Scholarship programs sponsored by local and foreign bodies, and (iv) Participation in international conferences and symposia.

As far as research infrastructure is concerned, generally speaking it is modest. Some research facilities are sufficient and up to date

depending on specialty (medicine, and pharmacy), and some are either insufficient or not up to date. The HCST is trying, through the national research and development networks (as part of its Science and Technology strategy (2005-2010) to establish an excellent research and development infrastructure for its current and future research and development priorities (advanced materials and nanotechnology, biotechnology, and ICT). As for the libraries at research centers and universities they are always up to date particularly in public universities and research institutes. Access to computers in 2003 for all Science and Technology units in Jordan was around 0.8 Computer per employee working in Science and Technology units (in 1996 this number was 0.34), out of which 0.18 for manufacturing industries (0.18 in 1996), and 1.6 for the education sector (0.6 in 1996).

2.4.8 Ability to Address Emerging Research and Development Priority Areas

Science and Technology in general and research and development in particular are really seen and looked at as one of the main drivers of change. This is always confirmed at the highest political levels. Moreover, the chairmanship and membership of the HCST reflects this fact. The chairman of the HCST is HRH Prince al-Hassan, and there are 8 ministers as members of the HCST. When it comes to implementation then the HCST is faced with some difficulties including those related to financing, and coordination at the national level. In summary one can say that having research and development as a major driving force for future national development is not yet up to aspirations. At the end of 2004, the HCST approved the Science and Technology strategy for the period 2005-2010, with focus areas of research and development fields including; Advanced materials and Nanotechnology; Biotechnology, and Information and Communication technologies. This is in addition to ongoing research in the areas of

Energy, Medicinal Plants, and Polymers. The reasons HCST believes in these focus areas include the availability of qualified human resources some of which is connected to prominent scientists abroad, and the need to follow international trends in modern and advanced research and development activities. It must be made very clear that modest advancement are made so far in these three focused areas, however, HCST believes that an important factor for success is the coordination with all stakeholders that form the innovation system (S and T) community, Legal Institutions, and financial institutions), which is currently not up to ambitions, and off course the cooperation with international related organizations.

2.4.9 International R&D Cooperation

As mentioned in section four of this report, the HCST is cooperating with several organizations and agencies all over the world. Arab countries include Tunisia, Egypt, and Lebanon. Cooperation with these countries is really limited due to limited financial resources. The HCST is participating in the implementation of several projects sponsored by the EU, and it is believed that this participation can be enhanced. It is expected that the Science and Technology association agreement will be signed with the EU by the end of this year, which we hope that greater benefit from EU sponsored projects will be gained by Jordan. This is in addition to the lately launched Jordan's Information Point.

2.4.10 Prospects for Advancing R&D in Jordan

The potential for advancing research and development in Jordan is really great. In order for this to take place there is a need to address the following concerns:

(i) Coordination and cooperation with all national stakeholders. This will help in harmonizing the different related policies to end up with an S&T oriented policy.

(ii) Allocating the necessary funding needed for the implementation of a national innovation policy and strategy.

(iii) Human resources development through advanced training, and higher education.

CONCLUDING REMARKS:

This chapter has highlighted the history of development of science through out the ages and reins; and explained the impact of cultural and political output in the advancement of such an important section of mankind life. The other part of it has given a clear picture to research and development of Science and Technology in the H. K. of Jordan. Many benefits have been earned and this will help us in analyzing its development and recommendation of some points for the betterment of Science and Technology in the academic and also all the related fields, which became the demand of the day under what we call globalization in the era of Science and Information Technology.

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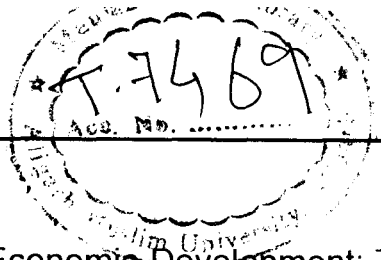

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Chapter Three

Development of Higher Education in Jordan

CHAPTER THREE

DEVELOPMENT OF HIGHER EDUCATION IN JORDAN

3.1 BRIEF HISTORY OF JORDAN

The Hashemite Kingdom of Jordan is inhabited by 5,760,000 persons (2005) and landspace of 92,300 sq km, it is situated on the Southern Western of Asia. It borders with Palestine in the west, with Syria in the north, Iraq in the northeast, and Saudi Arabia in the east and south. Amman is the Jordan's capital and its largest city. In addition to the capital, important cities include Zarqa, Petra, Irbid, Aqaba, and Salt. Jordan is a land steeped in history. It has been home to some of mankind's earliest settlements and villages, and relics of many of the world's great civilizations can still be seen today. As the crossroads of the Middle East, the lands of Jordan and Palestine have served as a strategic nexus connecting Asia, Africa and Europe. Thus, since the dawn of civilization, Jordan's geography has given it an important role to play as a conduit for trade and communications, connecting east and west, north and south. Jordan continues to play this role today.

Because of its centralized location, the land of Jordan is a geographic prize which changed hands many times throughout antiquity. Parts of Jordan were included in the dominions of ancient Iraq, including the Sumerian, Akkadian, Babylonian, Assyrian and Mesopotamian Empires. From the west, Pharaonic Egypt extended its power and culture into Jordan, while the nomadic Nabateans built their empire in Jordan after migrating from the south of the Arabian Peninsula. Finally, Jordan was incorporated into the classical civilizations of Greece, Rome and Persia, the relics of which are

scattered across the Jordanian landscape. Since the mid-seventh century CE, the land of Jordan has remained almost continuously in the hands of various Arab and Islamic dynasties. (Encyclopedia Britannica, 1993).[1]

The second geographical factor which has helped shape the history of Jordan concerns climate. Only the northern highlands and the Jordan Valley have received enough rainfall to support large populations. Therefore, this area has always been more settled by farmers, villagers and townspeople. Most of the urban civilizations of Jordan have been based in these fertile lands. To the south and east, meanwhile, there is very little rainfall and no rivers for irrigation. These desert areas, which comprise the majority of Jordan, have rarely supported large settled populations. In some periods, there appears to have been no settled population at all. The lifestyle of the Bedouin inhabitants of these desert lands has remained similar in some respects to that of their Edomite or Nabatean predecessors. The contrast between the pastoral "desert" and agriculturally fertile lands is particularly pronounced in Jordan, and much of the areas in history can be linked to population shifts between large urban centers and more dispersed, nomadic tribal groups.

The country situated is on the eastern bank of River Jordan, and has 16 miles (26 km) of coastline on the Gulf of Aqaba. Area: 34,495 sq mi (89,342 sq km). Population (2005 est.): 5,389,000. Capital: Amman. The vast majority of the populations are Arabs, about one-third of whom are Palestinian Arabs who fled to Jordan from neighbouring Israel and the West Bank as a result of the Arab-Israeli wars. Language: Arabic (official). Religion: Islam (official; predominantly Sunni). Currency: Jordan dinar. Four-fifths of the country is desert; less than one-tenth of the land is arable. The highest point of elevation, Mount Ramm (5,755 ft [1,754 m]), rises in the uplands region on the east bank of the Jordan

River. The Jordan Valley region contains the Dead Sea. Jordan's economy is based largely on manufacturing and services (including tourism); exports include phosphate, potash, pharmaceuticals, fruits and vegetables, and fertilizers. Jordan is a constitutional monarchy with two legislative houses; the head of state and government is the king, assisted by the prime minister. Jordan shares much of its history with Palestine. (Encyclopedia of Orient). [2] It fell to the Seleucids in 330 BC and to Muslim Arabs in the 7th century AD. The Crusaders extended the kingdom of Jerusalem east of the Jordan River in 1099. The region became part of the Ottoman Empire during the 16th century. In 1920 the area comprising Jordan (then known as Transjordan) was established within the British mandate of Palestine. Britain recognized Transjordan's partial independence in 1921, although the British mandate did not end until 1948. In 1950, after the end of hostilities with the new State of Israel, Jordan annexed the West Bank and east Jerusalem, administering the territory until Israel gained control of it in the Six-Day War of 1967. In 1970–71 Jordan was wracked by fighting between the government and guerrillas of the Palestine Liberation Organization (PLO), a struggle that ended with the PLO being expelled from Jordan. In 1988 King Hussein renounced all Jordanian claims to the West Bank in favour of the PLO. In 1994 Jordan and Israel signed a full peace agreement. (Robins, Philip, 2004).[3]

The land that became Jordan forms part of the richly historical Fertile Crescent region. Its history began around 2000 B.C., when Semitic Amorites settled around the Jordan River in the area called Canaan. Subsequent invaders and settlers included Hittites, Egyptians, Israelites, Assyrians, Babylonians, Persians, Greeks, Romans, Arab Muslims, Christian Crusaders, Mameluks, Ottoman Turks, and, finally, the British. At the end of World War I, the territory now comprising Israel, Jordan, the West Bank, the Gaza Strip, and Jerusalem was

awarded to the United Kingdom by the League of Nations as the mandate called "Palestine Trans-Jordan." In 1922, the British, with League approval under the terms of the Mandate, partitioned Palestine at the Jordan River and established the semi-autonomous Emirate of Trans-Jordan in those territories to the east. The British installed the Hashemite Prince Abdullah I while continuing the administration of separate Palestine and Trans-Jordan (later shortened to "Jordan") under a common British High Commissioner. The mandate over Trans-Jordan ended on May 22, 1946; on May 25, the country became the independent Hashemite Kingdom of Trans-Jordan. It ended its special defense treaty relationship with the United Kingdom in 1957.

Trans-Jordan was one of the Arab states opposed to the second partition of Palestine and creation of Israel in May 1948. It participated in the war between the Arab states and the newly founded State of Israel (see 1948 Arab-Israeli War). The armistice agreements of April 3, 1949 left Jordan in control of the West Bank and provided that the armistice demarcation lines were without prejudice to future territorial settlements or boundary lines. In 1950, the country was renamed "the Hashemite Kingdom of Jordan" to include those portions of Palestine annexed by King Abdullah. While recognizing Jordanian administration over the West Bank, the United States, other Western powers and the United Nations maintained the position that ultimate sovereignty was subject to future agreement. (Mahafdah, Ali 1989)[4]

Jordan signed a mutual defense pact in May 1967 with Egypt, and it participated in the June 1967 war between Israel and the Arab states of Syria, Egypt, and Iraq. During the war, Israel gained control of the West Bank and all of Jerusalem. In 1988, Jordan renounced all claims to the West Bank but retained an administrative role pending a final settlement, and its 1994 treaty with Israel allowed for a continuing Jordanian role in Muslim holy places in Jerusalem. The U.S.

Government considers the West Bank to be territory occupied by Israel and believes that its final status should be determined through direct negotiations among the parties concerned on the basis of UN Security Council Resolutions 242 and 338.

3.2 Land and People

Jordan falls into two main geographical regions. Eastern Jordan, which encompasses about 92% of the country's land area, is made up of a section (average elevation: 2,500 ft/760 m) of the Arabian Plateau that in the northeast includes part of the Syrian Desert. In the western part of the plateau are the Jordanian Highlands, which include Jabal Ramm (5,755 ft/1,754 m), Jordan's loftiest point. Extreme western Jordan is made up of a segment of the Great Rift Valley and includes the Jordan River, the Dead Sea, and the Arabah (a dry riverbed). The inhabitants of Jordan are mostly of Arab descent. The Palestinians (about 50% of the population) also descended from the people who lived in Palestine before the Arab conquest in seventh century, whereas the inhabitants of East Jordan (many of whom belong to Bedouin tribes) are of predominantly Arab ancestry. There are small minorities of Armenians and Caucasians. Arabic, the official language is spoken by virtually everyone. Many in the higher socio-economic groups also speak English. Over 95% of the people are Sunni Muslims; about 5% are Christians, most of whom are Greek Orthodox.

3.3 Economy

In the late 1990s, Jordan had an unemployment rate of almost 25%, while nearly 50% of those who were employed were on the government payroll. Poverty and a large foreign debt remained major problems. Less than 5% of the country's land is arable, and farm output is further limited by the small size of most farms, inefficient methods of

tilling the soil, and inadequate irrigation. The principal crops are wheat, barley, lentils, tomatoes, eggplants, citrus fruits, olives, and grapes. Many Jordanians support themselves by raising sheep, goats, and poultry. Manufactures are largely limited to basic items such as foods, beverages, clothing, construction materials (especially cement), and other consumer goods. Nearly 50% of the country's industry is based in Amman. Numerous artisans make items of leather, wood, and metal. Phosphate rock, fertilizers, and potash are produced in significant quantities. Oil was discovered in 1982, and a small oil industry that includes petroleum refining has been developed. During the 1970s and 80s aid from other Arab countries and remittances from Jordanian workers living abroad were important factors in the country's economy. A slowdown in both sources of income in the 1990s, as well as an influx of refugees, has slowed economic progress.

Jordan's transportation system is limited to a small network of all-weather roads and a narrow-gauge railroad (formerly part of the Hejaz RR) that enters Jordan from Syria and runs through Amman and to Aqaba, the country's only seaport. A modern highway running from Aqaba to Iraq has made trade and transportation more efficient. The annual cost of Jordan's imports usually far exceeds its earnings from exports. The principal imports are crude oil, machinery, transport equipment, foodstuffs, and manufactured goods; the main exports are phosphates, potash, fertilizers, and agricultural products. Jordan's leading trade partners are the European Union nations, Iraq, India, Saudi Arabia, the United States, and Japan.(Abu Jaber, Kamel, 1984)[5]

3.4 Government

Jordan is a constitutional monarchy. Under the 1952 constitution as amended, the most powerful political and military figure in the country is the king. He appoints a cabinet (headed by a prime minister

who exercises executive power in his name), which is responsible to the bicameral parliament consisting of a 40-member senate (appointed by the king) and a 110-member house of representatives (popularly elected to four-year terms). The 1989 elections were the first in 22 years, and in 1993 political parties were again permitted to field candidates, resulting in Jordan's first multiparty elections in 37 years. Jordan is divided into 12 administrative governorates (Muhafazah).

3.5 Early History to Independence

The region of present-day Jordan roughly corresponds to the biblical lands of Ammon, Bashan, Edom, and Moab. The area was conquered by the Seleucids in the 4th cent. B.C. and was part of the Nabatean empire, whose capital was Petra, from the 1st cent. B.C. to the mid-1st cent. A.D., when it was captured by the Romans under Pompey. In the period between the 6th and 7th cent. It was the scene of considerable fighting between the Byzantine Empire and Persia. In the early 7th century the region was invaded by the Muslim Arabs, and after the Crusaders captured Jerusalem in 1099, it became part of the Latin Kingdom of Jerusalem. In 1516 the Ottoman Turks gained control of what is now Jordan, and it remained part of the Ottoman Empire until the 20th cent.

After the fall of the Ottoman Empire in World War I, the region came under (1919) the government of Faisal I, centered at Damascus. When Faisal was ejected by French troops in July, 1920, Trans-Jordan (as Jordan was then known) was made (1920) part of the British League of Nations mandate of Palestine. In 1921, Abdullah I (Abdullah bin Hussain), a member of the Hashemite dynasty and the brother of Faisal, was made emir of Trans-Jordan, which was administered separately from Palestine and was specifically exempted from being part of a Jewish national home. A Jordanian army, called the Arab

Legion, was created by the British, largely through the work of Sir John Bagot Glubb. In a treaty signed with Great Britain in 1928, Transjordan became a constitutional state ruled by a king, to be hereditary in the family of Abdullah I, who was placed on the throne by the British. The country supported the Allies in World War II, and, by a treaty with Great Britain signed in 1946, it became (May 25) independent as the Hashemite Kingdom of Trans-Jordan.

3.6 Ancient Jordan

3.6.1 Paleolithic Period

During the Paleolithic period (c. 500,000-17,000 BCE), the inhabitants of Jordan hunted wild animals and foraged for wild plants, probably following the movement of animals seeking pasture and living near sources of water. The climate during this period was considerably better than today and therefore large areas of modern-day desert were open plains ideal for a hunting and gathering subsistence strategy. Evidence has also been found of Paleolithic inhabitation near a large expanse of water at Azraq. Paleolithic man in Jordan left no evidence of architecture, and no human skeleton from this period has yet been found. However, archaeologists have uncovered tools from this period such as flint and basalt hand-axes, knives and scraping implements. Ancient man also left clues to the nature of his existence beginning in Paleolithic times and continuing through the Neolithic and Chalcolithic eras.

3.6.2 Neolithic Period

During the Neolithic period (c. 8500-4500 BCE), or New Stone Age, three great shifts took place in the land now known as Jordan. First, people settled down to community life in small villages. This corresponded to the introduction of new food sources-such as cereal

agriculture, domesticated peas and lentils, and the newly widespread practice of goat herding- into the diet of Neolithic man. The combination of settled life and "food security" prompted a rise in population, which reached, into the tens of thousands.

The second basic shift in settlement patterns was prompted by the changing weather of the eastern desert. The area grew warmer and drier, gradually becoming virtually uninhabitable throughout much of the year. The distinction between the desert to the east and the "sown" areas to the west dates back to this watershed climatic change, which is believed to have occurred from around 6500-5500 BCE. The most significant development of the late Neolithic period, from about 5500-4500 BCE, was the making of pottery. Earlier attempts to fashion pottery from plaster have been discovered, but it was during the late Neolithic period that man began to systematically create vessels from clay. It is likely that pottery-making was introduced to the area from craftsmen arriving from the seminal civilizations developing to the northeast, in Mesopotamia.

The largest Neolithic site in Jordan is at Ein Ghazal in Amman. It consists of a large number of buildings, which were divided into three distinct districts. The houses were rectangular with several rooms, and some of them had plastered floors. The stone tower and walls found at Jericho show that defense was a consideration for Neolithic villages, as well. It seems as though Neolithic man practiced ancestor veneration, as archaeologists have unearthed skulls covered with plaster and with bitumen in the eye sockets at sites throughout Jordan (Ein Ghazal and Beidha), Palestine and Syria. Recently, archaeologists finished restoring what may be one of the world's oldest statues. The relic, which was found at Ein Ghazal, is thought to be 8000 years old. The statue is just over one meter high and is of a woman with huge eyes, skinny arms, knobby knees and carefully depicted toes.

3.6.3 Chalcolithic Period

During the Chalcolithic period (c. 4500-3200 BCE), copper was smelted for the first time. It was put to use in making axes, arrowheads and hooks, although flint tools also continued to be used for a long time. Chalcolithic man relied less on hunting than in Neolithic times, instead focusing more on sheep and goat-breeding and the cultivation of wheat, barley, dates, olives and lentils. In the desert areas the lifestyle was probably very similar to that of modern Bedouins. Tuleitat Ghassul was a large Chalcolithic village in the Jordan Valley. Houses there were built of sun-dried mud bricks with roofs made of wood, reeds and mud. Some dwellings were based on stone foundations and many were planned around large courtyards. The inhabitants of Tuleitat Ghassul used the walls of their houses for artistic or ceremonial purposes, painting bright images of masked men, stars and geometric motifs, perhaps connected with religious beliefs.

3.6.4 The Old Testament Kingdoms of Jordan

The Iron Age (c. 1200-332 BCE) saw the development and consolidation of three new kingdoms in Jordan: Edom in the south, Moab in central Jordan, and Ammon in the northern mountain areas. To the north in Syria, the Aramaeans made their capital in Damascus. This period saw a shift in the level of power from individual "city-states" to larger kingdoms. One possible reason for the growth of these local kingdoms was the growing importance of the trade route from Arabia, which carried gold, spices and precious metals through Amman and Damascus up to northern Syria. The bulk of the Biblical Old Testament took place during this period. There is little archeological evidence to fully support the Biblical account of the Israelites' occupation of Palestine. Although archaeologists have demonstrated that certain cities supposedly taken by the Israelites were indeed destroyed during

this period, it is equally feasible that they may have been sacked by invading Egyptian armies. It is probable that the "conquest" occurred more gradually than in the Biblical narrative, with the process more akin to waves of ethnic migration than a conventional military campaign.

According to the Biblical account of the Exodus from Egypt (c. 1270-1240 BCE), the Israelites requested permission to pass unharmed through the Kingdom of Edom. After having been denied permission, they skirted Edom to the east and continued north until they reached the borders of the Amorite country near Madaba. Not trusting the Israelites' intentions, and not wishing to place the added strain of thousands of migrants upon his food and water stores, the Amorite leader Sihon refused them passage as well. This time, the Israelites fought back and defeated Sihon, occupying his territory.

According to the Bible, the Israelites then continued their northward trek into the Kingdom of Moab, where the Moabite king set up an alliance between the five tribal kings of Midian (the Hijaz of Arabia). The increasingly powerful Israelites triumphed over the Midianites as well, and some of the tribes settled in the conquered territories. The prophet Moses apparently climbed, or was carried, to the top of Mount Nebo, where, according to some sources, he died. Joshua then led the remaining tribes across the Jordan River into Palestine. A united Kingdom of Israel arose there about 1000 BCE with Saul and David as its first kings. After the death of David's son King Solomon in 922 BCE, the kingdom divided into two, with Israel in the north and Judah in the south.

3.6.5 The Hellenistic Period

Although the influence of Greek culture had been felt in Jordan previously, Alexander the Great's conquest of the Middle East and

Central Asia firmly consolidated the influence of Hellenistic culture. The Greeks founded new cities in Jordan, such as Umm Qais (known as Gadara) and renamed others, such as Amman (renamed from Rabbath-Ammon to Philadelphia) and Jerash (renamed from Garshu to Antioch, and later to Gerasa). Many of the sites built during this period were later redesigned and reconstructed during the Roman, Byzantine and Islamic eras, so only fragments remain from the Hellenistic period. Greek was established as the official language, although Aramaic remained the primary spoken language of ordinary people. Alexander died soon after establishing his empire, and his generals subsequently struggled over control of the Near East for more than two decades. Eventually, the Ptolemies consolidated their power in Egypt and ruled Jordan from 301-198 BCE. The Seleucids, who were based in Syria, ruled Jordan from 198-63 BCE.

3.6.6 The Mysterious Nabateans

Before Alexander's conquest, a thriving new civilization had emerged in southern Jordan. It appears that a nomadic tribe known as the Nabateans began migrating gradually from Arabia during the sixth century BCE. Over time, they abandoned their nomadic ways and settled in a number of places in southern Jordan, the Naqab desert in Palestine, and in northern Arabia. Their capital city was the legendary Petra (now included as one of the Seven Wonders of the World on (07.07.2007), Jordan's most famous tourist attraction. Although Petra was inhabited by the Edomites before the arrival of the Nabateans, the latter carved grandiose buildings, temples and tombs out of solid sandstone rock. They also constructed a wall to fortify the city, although Petra was almost naturally defended by the surrounding sandstone mountains. Building an empire in the arid desert also forced the Nabateans to excel in water conservation. They were highly skilled water engineers, and irrigated their land with an extensive system of

dams, canals and reservoirs. Encyclopedia of the orient (www.lexicorient.com) [6]

3.7 IMPORTANCE, PHILOSOPHY & AIMS OF HIGHER EDUCATION

Higher education in the world includes the basic and Secondary Education. Higher Education has been of a great concern since twentieth century, in the hope of the role in the process of socioeconomic, cultural and political development. Human nature has turned into a special productive power through culture, which characterizes our age and future ages; in this framework, education represents an influential role in renewing work power and developing it quantitatively and qualitatively. (Saiyeadawi,Ahmad1988)[7] In spite of the discrepancy of the experts and researchers view in regard to the importance of university education, they agree that university education must face the world problems in which human beings face, including Jordan, the most prominent of which are the following. (Sangar, Salehah, 1988)[8] firstly, the shortage of natural resources and their high cost, secondly, Environmental pollution and the large scale of damage, thirdly, the decrease or drawback of economic growth; fourthly, the non-correspondence between the necessary needs of human beings and the products of science of technology, fifthly, the lack of identity of great sectors of society, especially young people, sixthly, the increase of hygienic problems, seventh, the contradiction of economic, political and social values, and eighthly, the growing increase of the population of the third world countries and the growing increase of food.

3.7.1 IMPORTANCE OF HIGHER EDUCATION

The importance of university stems from the fact that it is responsible for preparing intellectual, scientific, literacy, artistic and professional leaderships at their different levels and for all institutions of

society and sectors and facilities of these institutions. University is basically responsible for conducting researches and studies at all fields of life and domains of knowledge. University also has an important role in the field of public service in society by offering practical services to society on the part of teaching staff and students, utilizing its various facilities. The most prominent problems which face Jordanian society are: firstly, the continuous cultural and ideological modernization coming from the West and the Palestinians of conflict among three ideologies: Islamic, communist and capital, secondly, the continuous scientific and technologies challenge coming from the west and the east and the needs of the Jordanian society for the different experiences and skills of advanced societies. In this way, the west and the east control the offering of advanced appliances and industries to Jordan according to certain conditions, thirdly, the occurrence of social, economic and political problems resulting from the rapid progress accompanied by an imbalance between the values and aims imposed by the material progress and the host of values and aims polarized the interaction of the ideological heritage and society needs, and fourthly, the development of new intellectual and faith currents within Jordanian society, one of them tries to assert the identity of the Arab-Islamic society, and the other tries to borrow the western or Eastern solutions resulting from the material progress. Each of them has its philosophy which supports its positions and manner of treatment.

3.7.2 POLICY OF HIGHER EDUCATION IN JORDAN

The higher education in Jordan is being defined according to the law of higher education Act No 28 of the year 1985 as "the Education that is not less than one full Academic year after secondary stage". And according to the same Act the institution of higher education is defined as the "institution which is conducting higher education in Jordan,

including universities, higher institutes and the community's colleges and institutes."

3.7.3 Principles of Educational Policy in Jordan:

The principles of Educational policy in Jordan are as follows:

(i) Guiding the educational system to be in much conformity with the needs of the individual and society and to reach balance between them.

(ii) Providing opportunities to achieve the principles of sustainable education and to exploit the types of parallel education in coordination with authorized parties.

(iii) Emphasizing the importance of political education in the educational system, consolidating and practicing the principles of participation justice and democracy.

(iv) Guiding the educational process in a way that develops in the citizens' personality the ability to analyze, criticize, initiate, create, and have positive dialogue and to reinforce the values originating from the Arab, Islamic and Humanitarian civilization.

(v) Firmly establishing the scientific approach of educational system in regard to planning, execution assessment and developing research, assessment and prosecution systems.

(vi) Expanding the types of education in educational institutions to include the program of special education and talented students.

(vii) Emphasizing the concept of comprehensive experience to include professional and technological experience.

(viii) Emphasizing the fact that education is a mission and a profession which has its ethical and professional rules.

(ix) Guiding the educational system in a way that insures the centralization of general planning and the de-centralization of management.

(x) Cherishing scientific and social position of the teacher and his/her distinctive role in building the human being and society. And

(xi) Emphasizing the importance of military education and environmental culture.

3.7.4 The Means of Implementing the Policy of Higher Education:

The ministry of higher education was established in 1985 to take up control of the educational, cultural, instructional and scientific policy of the government within the scale of the institutions of higher education. Its aims are achieved under the regulations of higher education 1985 through the following means:

(i) Integrated scientific planning of higher education in the light of needs of society, including the planning for establishing the institutions of higher education and determining the type, level and degree of this education.

(ii) Supporting the autonomy of universities through their council and departments and co-ordination between them in different fields.

(iii) Direct supervision of non university education to prepare well trained human powers required for development plans and co-operation with other ministries, committees and institutions which have the same tasks.

(iv) Providing human and technical potentials for the institutions of higher education to promote the level of scientific research expand its domains and co-ordination, with the co-operation of concerned institutions and committees.

(v) Holding agreements related to higher education and exchange of information with Arab and other countries, and representing Jordan in conferences and local and foreign meetings related to higher education.

(vi) Organizing the affairs of students, professors, researchers and scientific delegates coming to Jordan from other countries in co-operation with concerned parties.

(vii) Organizing the work of the offices of student's services, supervising their affairs and evaluating their performance.

(viii) Preparing studies and projects and offering initiatives in regard to what concerns higher education and its development in Jordan.

3.7.5 The Philosophy of Higher Education in Jordan:

The following philosophy of Higher Education in Jordan is generally recognized:-

(i) Jordanians are equal in regard to rights, political, social and economic obligations and they are distinguished by the level of their efforts and belonging to their society.

(ii) Abiding by the freedom and dignity of the individual.

(iii) The progress of society depends on the organization of individuals in a way that insures national integrity.

(iv) Political and social participation in the frame of democratic system in a right for the individual and an obligation to society.

(v) Education is a social necessity and it is a right for all each one according to his/her own capabilities.

(vi) Abiding by the spiritual heritage of the Arab nation.

(vii) Abiding by unity of the Arab homeland.

(viii) Abiding by freedom, Democracy and social equity.

(ix) Abiding by achieving openness on development heritage.

(x) Abiding by the fact the university education is for public service.

(xi) Abiding by the scientific approach.

(xii) Abiding by the fact that university education is for all individual who can benefit from it.

(xii) Abiding by the independence and freedom of universities.

3.7.6 The Aims of Higher Education in Jordan:

The higher education in Jordan is aimed at:-

(a) Bringing up citizens who believed in God, belong to their country, bear responsibility, know and cherish the heritage and civilization of their nation and are aware of the issues, values and progress of humanity.

(b) Providing learners by and adequate amount of knowledge, sciences and applied skills which offer them a level of specialization that enables them to perform duties and give them the opportunity to broaden their range of vision and let them acquire intellectual and behavioral attitudes to increase their mental abilities, specialized information, fields of activities and creativity.

(c) Providing human powers for the needs of the plans of economic, social and cultural development, serving community and creating interaction, participation and co-operation between the institutions of higher education and other institution of society.

(d) Supporting, promoting and expanding scientific research and linking it to the needs of society, plans of development and production and civilization of nation.

(e) Using Arabic as the language of science and education at all stages of higher education.

(f) Making sure that learners master another foreign language at least to be a means of getting knowledge about the production of other nations at the fields of their specialization.

(g) Increasing scientific and cultural co-operation and broadening its domains in the field of higher education, with other states and institutions in the world, especially the Arab and Islamic countries.

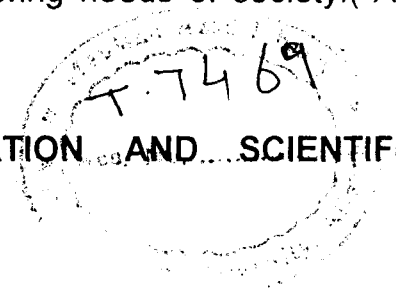
3.7.7 THE LEGISLATIONS OF HIGHER EDUCATION IN JORDAN

Legislation is the official source of the state in which it expresses the legal rules in a written form. It is divided, into three types: First one is the Constitution, secondly, Law and thirdly, Systems. Constitution or the basic legislation means "the host of rules which determine the political organization of a state" which is put forward according to two ways: being granted by the absolute rules, or by the way of contract between the absolute ruler and the representatives of people. The democratic way of drawing up constitutions is by a constituent association or general referendum. Constitution is placed high at the peak of the legal structure of state. There is no authority that can revolt against its rules; in the same way, there is no legal rule that contradicts with its rules. On the other hand, a law or a normal legislation comes next after constitution, and it is issued within the limits constituted by constitution to organize the different affairs of life in society. Constitution nominates the specialized authority to pass this legislation. In Jordan, it is the "legislative authority" which is attached to the parliament and the king. The parliament consists of lower house and senate.

The importance of legislations in organizing higher education is by referring to the Jordanian constitution of 1992, we find that it guaranteed the rights of individuals by stating: "Jordanians are equal before the law, no discrimination among them in regard to rights and duties, even if they differ in race, language or religion.". The Jordanian constitution guaranteed free education and considered it, to some extent, an obligation.

In accordance with these texts, many rules, systems and regulations were issued. Their starting point was the law of education number 16 for the year 1964 which it was stated that learning is free

and obligatory at elementary and preparatory stages and free at all types of secondary education. It was followed by the law of higher education number 3 for the year 1980. Then it was replaced by the law of higher education number 28 for the year 1985, and the law of Jordanian universities number 19 for the year 1987 which combined the common characteristics of official universities. The law Higher Education, number 28, for the year 1985, clarified the aims of higher education, stressing the necessity of educating citizens who belongs to their country, religion and Arabic nationalism, ensuring the need of development, economic, social and cultural plans, as well as supporting scientific research and linking it to the growing needs of society.(AL-Tal, Ahamad,1998)[9]



3.8 MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

Higher education in Jordan has obtained a great position in the last decade in regard to content, programs and modes of teaching and learning which govern quality and quantity education. The council of Higher Education and the Higher Committee of Scientific Research supervise the programs offered by public and private institutions of higher education in order to evaluate their effectiveness for accomplishing their missions and aims. Jordanian society has been greatly influenced by the revolution of information technology and communications. Quick positive measures have been taken to reach the standard of knowledge in societies. Jordan has realized the importance of developing its potentials and human resources to interact and deal with information economy through launching and carrying out several programs at both levels of general and higher education. All of this stems from the noble guidance of his majesty kind Abdullah II. "The development of human resources is one of our priorities for forthcoming stage because the greater fortune of Jordan lies in Jordanian human

being. Therefore, my government will take care of all the comprehensive aspects of information economy, curricula development and enhancement of scientific research and higher education:

The ministry of higher education and scientific research had formed ten specialized committees since the beginning of the academic year 2004- 2005. Consequently, a higher committee has been formed to present an integrated strategy of higher education and scientific research for the years 2005 – 2010. Its aim has been the achievement of an already determined vision of developing higher education in Jordan to reach an international level in order to play a basic role which could lead to information economy.

(www.mohe.gov.jo)[10]

3.9 THE PUBLIC SECTOR UNIVERSITIES IN JORDAN

The Universities are primarily considered to be responsible for conducting research and studies in all areas of knowledge and also life. The universities play an important role in public service of the society. Successive Jordanian Governments have recommended the establishment of universities and work to develop and provide full support to them through directions and orientations of His Majesty the late King Hussain. Thus, the first university in Jordan was established in 1962 and then many public and private universities were established in the kingdom totaling 26 in the year 2007; of them ten are public universities and sixteen are private universities, among them four universities are specialized in postgraduate studies. The government has issued a series of laws concerning higher education and Jordanian universities. The Uniform Code of universities Act 29 of 1987 confirmed that the university is a national institution of higher education and scientific research that aimed at: firstly, to disseminate knowledge,

develop and contribute to the progress of human thought. Secondly, providing opportunities of university education theoretical and applied to the qualified students and researchers. Thirdly, encouraging scientific research and development of scientific curriculum, intellectual independence, and personal initiative and developing sense of belonging to the nation and the spirit of responsibility and teamwork. Fifthly, deepen of the Islamic faith, spiritual, moral and also paying care towards Arab civilization and Islamic heritage. Sixthly, providing service to the Jordanian society and its needs and contribute to the service of the Arab society.

3.9.1. Public Sector Universities

1.1 University of Jordan

1.2 Yarmouk University

1.3 Mu'tah University

1.4 Jordan University of Science & Technology

1.5 Al al-Bayt University

1.6 The Hashemite University

1.7 AL-Balqa Applied University

1.8 AL-Hussein Bin Talal University

1.9 Al-Tafila technical University

1.10 German-Jordanian University

3.9.2. Private Sector Universities

Table 3.1 Private Sector Universities

S.No.	Name of the Universities	Year of the Established
1.	Al – Ahliyya Amman University	1990
2.	Al – Isra Private University	1991
3.	Princess Sumaya Uni. For Tech.	1991
4.	Applied Science Uni. (Private	1992
5.	Jerash Private University	1992
6.	Al-Zaytoonah Private Uni. Of Jordan	1993
7.	Educational Sciences Faculty	1993
8.	Philadelphia University	1993
9.	Irbid National University	1994
10.	Zarqa Private University	1994
11.	University of Petra	1994
12.	Jordan Academy of Music	1995

As per the scope of the present study, only Public Sector Universities have been described as under:-

3.9.1.1 University of Jordan

Established in the year 1962 and is located at Amman city. The University of Jordan's educational mission is based on the following pillars:

(i) The provision of quality education at both the undergraduate and graduate levels,

(ii) The adoption of the principle of democracy in the education and decision-making processes,

(iii) Interaction among students, with the local community, and at the international level, and

(iv) Support of goal-oriented research, particularly research activities which are in line with the national development plans. It has a number of faculties of different fields, such as, The Faculties of the university are. Medicine, Dentistry, Pharmacy, Nursing, Engineering and Technology, Science, Business Administration. Law, Shari'a (Islamic Studies), Humanities and Social Sciences, Educational Sciences, Rehabilitation Sciences, Agriculture, Physical Education, Arts, Information Technology, Graduate Studies (FGS). The University of Jordan launched its first graduate program after six years of its establishment (1968/69). This was an MA program in Educational Administration and Guidance, to be followed, three years later, by an MA Program in History. The University gathered momentum in the second decade of its life; new faculties were established and it started to pay more attention to research and graduate studies. This was reflected in launching eight new graduate programs in the

academic years 1972/73 and 1973/74. To administer these graduate programs, the Deanship of Research and Graduate Studies, as of 1984 the Faculty of Graduate Studies, was established in 1973 with the following aims:

(i) To increase human knowledge,

(ii) To lay foundations for research in the University,

(iii) To develop students' capabilities in research methodology in all fields,

(iv) To graduate specialists of high standards to help in national development,

(v) To direct studies toward local, regional and Arab problems.

The Faculty of Graduate Studies admits students from many Arab and foreign countries either through the International Graduate Program or through cultural exchange programs.

Table 3.2 Academic staff of the Public University

S. No.	Name of Universities	Full Prof.	Associate Prof.	Assistant Prof.	Instructor	Lecturer	Res. Ass.	Total
1	The University of Jordan	331	222	352	54	91	79	1129
2	Yarmouk University	206	176	205	116	0	67	770
3	Mu'tah University	106	149	152	22	96	13	538

4	Jordan University of Science & Technology	97	153	282	3	138	15	688
5	AL al – Bayt University	17	19	138	55	0	0	229
6	The Hashemite University	38	45	200	24	50	88	445
7	Al-Balqa' Applied University	22	29	113	51	14	73	302
8	Al-Hussain Bin Talal University	6	15	67	9	15	6	118
9	Tafila Technical University	3	14	40	20	20	21	118
10	German Jordanian University	3	2	5	0	8	0	18

Shows academic staff of the university for the year 2005/ 2006. It is observed the University of Jordan has the largest rank of academic staff of 352 assistant professors, followed by 331 full Professors, 222 associate professors, whereas, the other reaming ranks, have the

lowest academic staff in order, 91 lecturers, 79 teaching and research assistants, and 54 instructors, during the academic year 2005/2006.

University Library

The University of Jordan's main Library was established in 1962 and it has been endowed with major attention. Providing it with a qualified technical staff and the required financial shares, have contributed in establishing it as a pioneer library in both the Arab World and the Middle East region. More than 800,000 library titles are available in forms of books, periodicals, theses, microfilms besides a number of audiovisual materials. The library offers a number of services for the university members, the students, the academic and administrative staff as well as researchers from outside university and the local community. It opens its doors to offer its daily services to visitors range between 5000 and 10000 a day. The library has undergone an automation project offering a computerized system of acquisition, borrowing and returning books. Through its effort to enhance the role of technology in modern libraries, UJ library has activated the project of the e-library by allocating certain databases for subject-heading search, thesis abstracts search, the UJ educational publishing search including studies, and the educational magazines. It has recently undergone a project of providing a full-text search for theses defended since 2002.

By coping with the latest technological events to maintain our service in providing all kinds of information resources that cover all sorts of disciplines available at the faculties of the University of Jordan, we can ensure the easiest and the most efficient access to all of the library items. Working on our vision to see the light, we have recently signed an agreement with the official Jordanian universities to form a Consortium that combines all of the universities libraries under the

name of "Jordanian Center of Excellence for public University Library Services" located at Yarmouk University. The aim of the Consortium is to manage Jordanian universities libraries information network and coordinate its services for multi-economical- purposes (expenditure rationalization, information resource sharing and unifying mechanism for library work among the member libraries. Thus was the choice of a new library system namely, Horizon to be installed in the year of 2006.

(www.ju.edu.jo)[11]

3.9.1.1 Yarmouk University

Yarmouk University is located at Irbid and founded in 1976 by a Royal Decree. It has since grown in size and stature to become one of the most prestigious universities not only in the country but the region as a whole. It is a foremost institution of higher learning, known for its innovative approach to academic management, human resource development and the pursuit of excellence in research and teaching in varied areas of the arts, humanities and social sciences. The university is a government funded institution, but enjoys a considerable degree of autonomy. The main missions of the university are: The first is to provide quality education to our students in all fields of specialization and at every level. The second is to encourage meaningful research programs that not only are relevant to the economic growth and development of the country but also to human welfare and prosperity. The third is to engage in public service at the local, national and international levels by fostering cultural enrichment and providing educational and training opportunities to the public at large. Being aware of the importance of partnerships and cooperation, we have academic agreements with several universities and institutions all over the world. It is committed to the discovery of new knowledge and techniques, exchange of information, and transformation of our youth

and nation to be able to face the challenges of the future. It has a number of faculties of different fields, such as, The Faculties of Engineering and Technology, Information Technology and Computer Sciences, Science, Economics, Arts, Law, Shari'a and Islamic Studies, Education, Archaeology and Anthropology, Fine Arts, Physical Education. Table 3.2 shows academic staff of the university that has the largest rank of 206 full Professors, followed by 205 Assistant Professors, 176 Associate Professor, 116 Instructors and 67Resarch Assistant

University Library

The library of Yarmouk University was established in 1976, with an aim to

(i) Provide all sorts of information sources to different classes of library users.

(ii) Processing these sources, and making it organized and systematic

(iii) Developing sufficient understanding among the users so as to enable them to fully utilize the available information sources.

The library has more than 500,000 sources in various fields and diverse languages. These sources range from printed materials, microfilms to digital ones. There are 400,000 books, 70,000 volumes of printed journals, 1900 microfilms, in addition to a collection of Bibliographic data on CDs or internet. The library subscribes 600 periodicals in different disciplines of the university. The yearly record of lending and returning of books reaches 4500.

The library uses the latest international system for organizing, retrieving its treasures of knowledge. Library of Congress Classification, and Anglo-American Cataloguing rules are followed for processing the documents. The Horizon system is also used in different library operations. For systematic photocopying and printing, machine cards are used. The library is also equipped with a modern laboratory for producing and processing microfilms. To access local as well as international database, the library has a versatile lab for automated search. The development of (EBSCO) like digital library for standard academic periodicals of the Arab world is underway. Yarmouk University/Library, built on an area of 18000 sqm., has all Information Technology (IT) requisites and public security arrangements. To conclude, the library is sufficient enough for the necessities of the university community for 30 years to come. (www.yu.edu.jo)[13]

3.9.1.3 Mu'tah University

Mu'tah University was established in the year 1981 and is located at Karak. The aims of the university are to qualify military and civilian professionals, capable to face current and future challenges through an integrated educational environment that fosters applied teaching and research to enrich national sustainable development. The University is currently undergoing vigorous expansions in all academic domains so as to enhance its role in serving the local community and the country as whole in addition to providing quality education for the students. At present, the University comprises twelve faculties such as Arts, Engineering, Science, Law, Business Administration, Educational Sciences, Sports Sciences, Shari'a, Agriculture, Nursing and Paramedics, and Medicine, Social Sciences. This is in addition to the Deanship of Students' Affairs, the Deanship of Scientific Research, the Deanship of Higher Studies, and the Center for Southern Studies and Continuing Education, Computer Center and many other facilities. All of

these Faculties are equipped with the most modern laboratories and computers facilities to serve teaching and research. In the field of postgraduate studies, the University has recently established a Ph.D. programme in Arabic language and literature in addition to various master programs in Mathematics, Arabic and English Languages, Geography and Electrical Engineering (Communications), Law and Police Studies. There are many plans to establish other programmes to keep up with contemporary changes in science, technology and education. The University ranks as number one amongst Jordanian Universities in enrollment for evening studies. The evening studies programme has been established with the aim of serving employees in the local community and in Jordan as a whole to continue their education. In addition, the university offers parallel studies Programs in many fields of studies. Mu'tah University is considered now as one of the biggest universities in the country with a total intake of nearly 16,000 students from all over the country and abroad. Table 3.2 shows academic staff of the university. It has a number of faculties such as- 152 Assistant Professors followed by 149 Associate Professors,106 Full Professor, 96 Lecturers, 22 Instructors and13 Research Assistants.

University Library

Established in 1984, the library of Mu'tah University has been linked and developed in the fields of higher education and scientific research. It has grown to achieve the development in the fields of general knowledge, information technology and documentation needs of its users. The library offers a variety of services through the central library and its branches. The library is becoming a member of the governmental consortia and the Centre of Excellence enhances the adoption of the e-archiving and Horizon project. The library has many sub-libraries such as: the library of military wing, the Medical library situated at the medical campus in al-Mosherfeh, al-karak, and the

library of princess Mona Nursing College situated at al-Hussein Medical City in Amman. The library of the Faculty of Agriculture situated at al-Raba north of al-Karak city. This library was founded to offer a variety of library materials to fulfill the needs of researcher. Its major function is to: offer the academic and culture library material which facilitates the process of research, and scientific studies by the variety of resources of the general knowledge. Secondly, using the modern technologies to arrange the special library collections. Thirdly, it offers a variety of services to the university faculty members, researchers, students, and interested readers from local society. Fourthly, it helps to develop the educational and instructional process and help the library members and students gain access to the necessary library reference as well as other library material in the fields of specialization. Fifthly, the library has grown steadily and expanded its services and holdings to local society and abroad, and sixthly, the library is responsible for all the library maternal borrowings process. In addition to the various reading halls for its users, and lastly, it works as centre of information technology. It is responsible to provide assistance to readers and researchers. (www.mutah.edu.jo)[14]

3.9.1.4 Jordan University of Science and Technology

Jordan University of S&T was established in the year 1986 and is located at Irbid. it has a number of faculties of different fields, such as The Faculties of Graduate Studies, Engineering, Medicine, Dentistry, Pharmacy, Nursing, Applied medical Sciences, Veterinary Medicine, Agriculture, Computer and Information Technology, Science and Arts. The University recognizes its obligations to contribute to the development of human and material resources of Jordan through the proper pursuit of knowledge and the achievement of academic excellence. In compliance with dictated objectives as contained in the

constitution of the University, it endeavors to realize these ambitions, including:

(i) Offering of specialized higher education in established and emerging disciplines of science and technology.

(ii) Preparation of properly trained human resources in areas of science and technology, with particular emphasis on quality programs.

(iii) Expansion of graduate studies, and support of scientific research and professional studies in the pursuit of promoting community service and bilateral links with industry. Last but not the least of all, the development of student personality traits of national pride and professional ethics via a balanced program of extracurricular activities envisaged to form an integral part of student life on campus. Table 3.2 shows academic staff of the university with 282 Assistant Professors, followed by 153 associate Professors, 138 Lectures, and 97 full Professor, the other remaining academic staff are 15 lecturers, and three instructors.

University Library

The library of Jordan University for Science and Technology is established in 1986; the university library has close links to the educational and instructional process of the university. It aims at providing information resources to the university community in support of the instructional and research programs of the university. It works towards developing the students' skills in using its resources to achieve their academic goals. The Library has collection of books and periodicals which comprises 115,000 books, 45,000 volumes of back issues of periodicals. In organizing its collection the Library adopts the

Library of Congress Classification Scheme. It uses the Anglo-American Cataloging Rules and the International Standard of Bibliographic Description in cataloging its collection. To cope with the new technologies in the field of library and information science, the Library in the year 1993, started to offer retrieved information services through a good number of necessary databases, which are available on CD-ROM or online. The University Library provides high quality library collections and information services in support of teaching, research, and service functions of the university. The Library of Congress Classification system is used to arrange books on the shelves. The letters stand for broad topical areas are arranged alphabetically. The main mission of the Jordan University Science and Technology Library is to support the educational program of the College. The library has been established so as to achieve the following objectives for serving this mission: firstly, to develop a collection of library materials in a variety of formats to support the curriculum; secondly, to provide access to the library collection as well as to off-site resources in a timely and efficient manner; Thirdly to provide information literacy program for the academic community; fourthly, to renovate the library and to acquire additional interior library space in order to enhance the learning environment, and fifthly, to maintain a highly qualified library staff capable of providing appropriate services to support the library mission. (www.just.edu.jo)[15]

3.9.1.5 AL al-Bayt University was established in the year 1993 and is located on the outskirts of the city of al-Mafraq 65 Kilometers to the north-east of the capital Amman. The university has integrated academic facilities Islamic Jurisprudence and Law, Art and Humanities, Information Technology, Sciences, Economics and Administrative Sciences, Nursing, Educational Science, The Institute of Earth and Environment, The Institute of Architecture & Islamic Arts, The Higher Institute of Islamic Studied, The Institute of Bayt al-Hikmah (House of

Wisdom). Al al-Bayt University is a public educational institutions of an Arab and Islamic nature, It aims to:

(i) Form the rounded Muslim personality that is attuned to its environment and to the civilization of the modern world by combining and harmonizing modern scientific knowledge and methodology in teaching, and the requirements of belief and clarity of vision,

(ii) Acquaint the Muslim not only with his own culture, but with the numerous cultures of the world, in order that he/she may place his/her own culture in the context of different cultures and identify the role he/she may play to enrich modern civilization with elements derived from his/her own background,

(iii) Activate Muslim participation in all fields of modern life without any debilitating sense of alienation or isolation, and to strengthen the Muslim's ability to communicate with other people in an atmosphere of tolerance and friendliness,

(iv) Deepen the values of freedom of thought and expression, and of tolerance and co-existence based on dialogue and mutual understanding,

(v) Present the true image of Islam as a way of life that does not seek imposing itself on others,

(vi) Purify Islam of all secret intentions entrained by individuals or groups and of attempts at achieving sectarian, factional, or individual advantages,

(vii) Teach Islam through persuasion and understanding, not preaching and proselytizing, and,

(viii) Teach the various sciences that can promote the mission of the University, with a view to preparing the Muslim both scientifically and religiously. Table 3.2 shows that the academic staff of the university has moderately large rank of academic staff as of138 Assistant Professors, while the reaming ranks of 55 Instructors, 19 Associate Professors, and 17 Full time Professors,

University Library

The library was established in 1994/1995 with an aim to provide all sorts of information sources, both conventional and automated. Al-Albait library serves the users through online search, circulation, photocopying and reference sections.

The library owns 179000 books, of which 140000 books are in Arabic and 39000 in different foreign languages. The numbers of subscribed journals reaches 121 in foreign languages and 50 in Arabic. In addition to it, the library has scores of international database on CD's and access to internet based based services including EBSCO.

For the systematization of its collection, the library follows Library of Congress Classification System and Anglo-American Cataloguing Rules.

The library consists of three main buildings and also departmental and seminar libraries of the university. (www.aabu.edu.jo)[16]

3.9.1.6 The Hashemite University The Royal Decree ordaining its establishment was issued in, 1995. Since then, it has been working in

support of higher education, scientific research and community service through providing the society with competent and qualified graduates and specialists in different fields and majors. Teaching at the University started at the outset of the Academic year 1995/1996, and the students were admitted to the three functioning faculties at the time. The university has grown in size, status and stature over these few years. The university now includes faculties, Engineering, Sciences, Medicine Nursing, Allied Health Sciences, Economics and Administrative Sciences, Educational Sciences, Physical Education and Sport Sciences.

The Hashemite University adopts the credit-hour system which is characterized by flexibility and the freedom of choice and variety it provides to students. Moreover; this system facilitates the interaction between students of different majors especially when they meet in selective courses chosen according to their personal tendencies and desires. The University is a four-year coeducational institution committed to excellence in teaching and research. Its grand mission is to offer service and consultation to the local community in addition to the larger society. The University's Educational mission is based on the following pillars:

(i) Giving the opportunity of studying and specializing in different fields and majors to both students and the community,

(ii) Increasing general knowledge with concentration on the levels and quality of teaching,

(iii) Conducting and encouraging scientific research, intellectual independence, taking personal Initiatives and team-work spirit,

(iv) Taking care of humanities, sciences, arts, culture and national and universal heritage,

(v) Cultivating the Arab Culture and the Islamic Faith by spreading their heritage, promoting their values and morals and fostering a sense of belonging and the spirit of responsibility towards one's homeland,

(vi) Ensuring a qualified staff of Professors, Technicians and Administrative personnel, preparing plans for the processes, studying and evaluation in accordance with the traditions of higher education in Jordan,

(vii) Helping students develop a strong personality in all the academic, cultural and physical aspects of their personalities, and,

Holding a strong belief in the principle of full cooperation and coordination with other universities and scientific institutions home and abroad. Table 3.2 shows academic staff of the University with 200 Assistant Professor followed by 88 Research Assistants, 50 lecturers, while, 45 Associate Professors, 38 Full Professor, and. 24 Instructors

University Library

This library is established in 1995, it is committed to providing effective literature and information support to the academic and research activities through a wide variety of resources and services. The library has a collection of more than 150,000 volumes of books and journals, approximately three thousand items in microform, and a selection of audio-visual media. In addition to more than fifteen thousands online, Internet accessible titles through different online Databases, the University library acquires five hundred current Arabic

and foreign periodical titles through subscription, gift and exchange: (i) online databases (ii0 Ulrich's periodicals (iii) global periodical (iv) Arabic periodical (v) electronic books, and (vi) databases CD-Rom.

An inter-library loan system has been developed to acquire materials not available in the library from major, local and foreign libraries and information centers. The book stock is arranged in a classified sequence based on the Dewey Decimal Classification System. Books and periodicals are housed on open stacks, providing a free and an easy access to library materials. To provide better services, all major library functions have been computerized using the ORACLE database management system. Fifteen terminals are available in the library for searching the OPAC. The library has a microfilm/microfiche reader-printer, eight photocopiers, and a complete set of audio -visual units. Three CD-ROM work stations and internet terminals are available for literature searching in the Databases Division. In addition, the library holds an internet and computer lab, which comprises more than eighty four terminals, to be used by researchers and students. The library consists of two main departments: The department of library services, and the technical department. The staff of the library is committed to providing the best possible service to the University faculty members, researchers, students and interested readers from outside the University. (www.hu.edu.jo)[17]

3.9.1.7 AL- Balqa Applied University is a public university established by the virtue of a royal decree in the year 1997 under the auspices of his majesty the late King Hussein, to provide qualified professionals who could focus on applied technical studies, besides the academic studying in different fields to encounter all contemporary challenges faced by advanced technology. The University has been located the year 1993 and located at al-salt and has the faculties of Engineering, Agricultural Technology, Planning and Management, Graduate Studies

and Scientific Research, Science and Information Technology. In addition to this, the University has a Department of Studies and Research. The aim of establishing this department is focused upon the following: firstly, encourage applied studies and scientific research directed towards servicing the developments of the community. Secondly, set a master plan for scientific research projects and seek financial support for these researches from various institutions in Jordan and abroad. Thirdly, Encourages and seek collaboration with scientific institutions in Jordan and abroad for integration purposes which serves the scientific research and to improve its standard. Fourthly, establish joint scientific research projects with other institutions inside Jordan and abroad to serve the development of the societies. And fifthly, to supervise graduate student with the collaboration of the academic departments to do their research project in the department. Table 3.2 shows academic staff of the University with 113 Assistant Professor followed by 73 Research Assistants, 51 Instructors, while, 29 Associate Professors, 22 Full Professor, and 14 lecturers.

University Library

This library was established in the same year along with the university during the academic year 1997/98. The university administration has given special attention to its library by providing the required well –trained and skillful staff. Also the university administration provides the needful financial support which puts the library among the best in the country. The library is situated on land of 45,000 m^2 area and it has more than 28,000 academic items. The teaching faculty, students and administrative staff are benefited from the books. Also the researchers from other Arab and Jordanian universities are benefited from the library's books and references. The library had introduced the electronic books surfing system (e-library) in all of its sections which had given and provided the needful information in convenient time through

the internet. The main objectives of Library of al-Balqa University are as follow:- Firstly, provides the required data, scientific information and stands as sources to the teaching community, students, administrative staff and the society. Secondly, arranging and storing the resources in order to be referred easily. Thirdly, developing and training of the library staff and also the staff of other libraries through the modes of giving lectures and training workshops. Fourthly, to provide the needed cooperation, exchange of experience and information with other centers of information internally and also externally (inside and outside Jordan). The fifth major objective of the library is to provide book-exhibition and participate in publication of books which help the students and the society in general. Sixthly, the library, technically supervises over the medium size libraries of the university's different faculties (colleges) which are functioning as sub ordinates to it. This supervision is through, giving the needful assistance, development and providing technical courses and workshops to the staff. (www.bau.edu.jo)[18]

3.9.1.8 AL-Hussein Bin Talal University was established by a Royal Decree in April 1999.It is located in the southern part of Jordan, where almost all educational disciplines are needed, particularly Tourism, Hotel Management, Science, Computer Engineering, Education, and Mining Engineering. The University's main campus is located seven Kilometers to the west of the city of Ma'an. Objectives of the university are-providing specializations and high quality programs responsive to the needs of the surrounding human and natural environments that contribute positively in the national development, conducting scientific researches that heavily concentrate on the application field, contributing in the development of the local communities, and, excelling in application of quality assurance standards on education, management, and installations. Table 3.2 shows that academic staff of the university has moderate rank of 67 Assistant Professors, followed by 15 Associate

Professor, 15 Lecturers, while, the other remaining ranks have nine Instructors, six Full Professors, and six Research Assistants.

University Library

The Library was set up in 1999-2000 to serve the faculty members students as well as the local populace, organizing information sources as per the latest international systems of storage and retrieval. Dewey Decimal Classification system and Anglo-American Cataloguing rules are in practice.

The library has several halls of a total area of 11000 sq.mt. and 53000 books both in Arabic and foreign languages. This is an addition to subscribed periodicals and on line international database. The provisions of reference, issue & return, photocopying and online search services are available in the library. (www.ahu.edu.jo)[19]

3.9.1.9 Al-Tafila Technical University was established in the year 2005 at al-Tafila and has the faculties of Engineering, Science, Administration and Financial Management, Education Science, Arts .

Table 3.2 shows academic staff of the university with moderate rank of academic staff of 40 Assistant Professors, followed by 21 Research Assistants and, 20 Instructors, 20 Lecturers, 14 Assistant Professors, and Three Full Professors.

University Library

The Library aims to develop and modernize its services, and increases its treasure of books covering various disciplines offered by the university. The library uses ICT in all its functions, and computerization of its collection in order to keep pace with developments of the university, by using Horizon system through the

Centre of Excellence. The area of the library is almost 1,050 sq.mts. The initial asset of the library was about 22,000 books and reference sources in 2005. It rose to 70 percent the very next year i.e. 2006, by adding another (13,000 books and reference sources) Total number of Periodicals subscribed by the library is 67 only. Library started subscriptions of the electronic databases in 2007. The electronic resources available are about 250 CDs. The seating capacity is only 320, where as the number of students is about 2500. There is a 400 sq.mts hall for books, another hall of 300sq.mts for Reference Sources and a third hall of 150 sq.mts for periodicals. An internet lab with 27 computers has recently been operational since October 2006.

Objectives of the Library are: To index library books according to the Library of Congress Classification. Secondly, to an additional increase the books and references sources to 10,000 titles during the year 2007. Thirdly, to subscribe electronic periodicals through databases of Science Direct, IEEE, EBSCO. Fourthly, to develop OPAC for library collections and computerization of other in-house library operations. Fifthly, to provide in-service training of the staff to use the (Horizon) system through center of excellence, in order to computerize its assets particularly in sections of acquisition of books, circulation and periodicals. Sixthly, to encourage the teaching staff and students to go to the library and take advantage of its services. Seventhly, to communicate with the local community, universities and institutions at home and abroad through gift and exchange programme. (www.ttu.edu.jo)[20]

3.9.1.10. German-Jordanian University was established in the year 2005 at Madaba. It has School Business, Medical Science, Information and Computing, Technological Science, Applied Natural Science, Architecture and Design.

Table 3.2 shows academic staff of the university has lowest rank of academic staff with 8 Lecturers followed by 5 Assistant Professors, 3 Full Professors, and two Associate Professors.

University Library

The University Library was founded during the academic year 2006/2007 aiming at collecting sources of all different sorts of traditional and electronic information. The library is using the latest automation systems to organize their collections, retrieval and transmission using Anglo-American Cataloguing rules. The library has used Horizon system for computerization through the Centre for excellence (network of universities libraries). The Library seeks to keep pace with modern developments through participation in electronic databases to provide better services to its research faculty members, students and the society. The library also keeps its staff up-to-date by involving them in sessions convened by the Center for excellence in using the Horizon system. (www.gju.edu.jo)[21]

3.10 Jordanian Centre of Excellence for Public University Library Services:

The centre, having it headquarter at Yarmouk University, was setup in April 2004 with the collaboration of ten universities namely-

Library of Yarmouk University, Library of University of Jordan, Library of Mu'tah University, Library University of Science and Technology, Library of Al al-Bayt University Library, Library of Al Hashimiyah University, Library of Al- Balqa Applied University, Library of al-Hussain Bin Talal University, Library of al-Tafila Technical University and Library of German Jordanian University. The establishment of this centre is based a memorandum of understanding signed by all these Jordanian public universities. The Centre attempts to manage the public

university library network in Jordan and coordinates its services to achieve expenditure channelization, information resource sharing and unifying mechanism and tools for library work among member libraries. The objectives of the centre are: to maximize utilization of human, physical and financial resources available at the member libraries. Expenditure channelization through unification of purchasing mechanism and collective subscriptions of printed as well as electronic information resources. The centre is to reinforce a constructive cooperation framework among member libraries, and unifying work mechanism and its tools according to professional library standards, and also establishing the national information networks and the Jordan digital library.

Functions of the centre are:

(i) Managing the integrated library system (ILS) centrally to minimize the burden of individual management on each member library.

(ii) Establishing and maintaining the union catalog to facilitate the access to the accumulative information resources available at the member libraries.

(iii) Providing consultation and advice in library automation and integrated library systems.

(iv) The Centre is assisting in gathering and facilitating access to different information sources by virtue of creating electronic linkages among them.

(v) Providing education, consultations and training in librarianship and information disciplines, and issuing training certificates on behalf of the Center.

(vi) Designing user interfaces for local and regional information library systems.

(vii) Managing authority files and ensuring quality to the bibliographic database.

(viii) Also the centre has to facilitate inter-library borrowing among member libraries as well as document delivery services.

(ix) Marketing the services of the centre at domestic and international levels.

(x) Strengthening the collective discussions among the member libraries for purchasing or subscribing the relevant electronic information sources.

(xi) Financing the workshops, conferences and other opportunities for technical promotion.

(xii) Supporting other activities approved by the Board of Trustees. The Center is managed by a Board of Trustees consisting of Jordanian public University Library Directors, headed by a Vice President of a member university for a term of one year.

Management: The Jordanian Center excellence for Public University Library Services is governed by the laws of higher education in Jordan.

Membership: Each university constitutes an independent member at the Centre and is committed to pay the membership fees as approved by the Board of Trustees. Each University must contribute with its bibliographic records for the purpose of creating and maintaining the union catalog. The member library should also participate in inter-library borrowing program as agreed upon by the Board of Trustees. This participation is a basic condition for membership in the Center. Any

member in the Center is also committed to provide document delivery services to support the inter-library borrowing. A member university shall be committed to contribute to the management of the Center's functions through effective involvement in the Center and work groups formed to maintain the union catalog and inter-library function. Each university shall be committed to the responsibility of copyright protection and fair use of assets according to the local copyright laws in Jordan.

(www.jopuls.org.jo) [21]

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(21) www.jopuls.org.jo

Chapter Four

Literature Review

CHAPTER FOUR

LITERATURE REVIEW

4.1 INTRODUCTION

A literature search is generally conducted to review the present status of a particular research topic. From the survey of literature, a researcher is able to know the quantum of work already done on his own research topic. The output of literature at the national or international level is searched with the help of research reports, articles, books and other materials. The major benefits of literature review are:

i. Helps the researcher in avoiding duplication of efforts on the same research topic (case study).

ii. Helps the researcher in adopting methodologies used successfully by other researchers/scientists.

iii. Suggests new approaches in planning/ the investigation/research.

iv. Helps to narrow down the research problem more clearly.

v. Assists investigators to develop firmer understandings of theoretical implications of proposed inquiries.

4.2 SURVEY OF SCIENTOMETRIC / BIBLIOMETRIC STUDIES:

The studies of scientometrics/bibliometrics mainly fall into two broad groups. One group is descriptive studies dealing with the characteristics of literature and is not only concerned with representing sincerely the features available in the current literature, but also interested in the condition of past literatures. Specifically, in areas where past studies constitute an important part of the current

researches. The other group of studies examines the relationships formed between components of literature known as behavioral studies; with all its documentation relying on the information contained within previously published documents.

Numerous theoretical and empirical studies have been conducted on the subject at the international level, which have been reviewed in the following pages. This is followed by the review of Islamic/Arabic literature on the subject.

(Price, 1965)[1] had attempted to describe in the broadest outline the nature of the total output of scientific papers. Price's contribution is regarded as a key event in the development of the field of scientometrics. He tried to picture the network that's obtained by linking each published paper to the other papers directly associated with it. He has been explaining the incidence of references and incidence of citations and emphasized that the total number of citations must exactly balance the total number of references. He said that: "...it appears that the citation network shows the existence of two different literature practices and of two different needs on the part of the scientists. (i) The research front builds on recent work, and the network becomes very tight. To cope with this the scientist...in physics and molecular biology) needs an alerting service that will keep him posted, probably by citations indexing, on the work of his peer and colleagues. (ii) The random scattering of...item as if it were truly part of the eternal record of human knowledge." From preliminary and analysis, he concluded by saying: "...a very large fraction of the alleged 35,000 journals now current must be reckoned as merely distant background noise, and as very far from central or strategic in any of the knitted strips from which the cloth of science is woven" (Price, 1965, p. 515). He (1963)[2] had raised many fundamental questions which have led to the scientometrics study of our time (today), namely, why should we not

turn the tools of science on science itself? Why not measure and generalize, make hypotheses, and derive conclusion?

(Moravcsik, 1977)[3] presented review of a number of studies related to the analysis of scientometric literature. He accepted the argument that: one day the reader will say, "have the natural sciences not been quantified a long time ago?" His article aimed in one part at readership that is not actively involved in the science of science, and whose geographical location might not enable it to have access of references. He presented a kaleidoscopic overview of recent developments in the quantification of the study of science. He surveyed a variety of quantitative measures of science, namely, input measure, assumption for output as a measure, scientific authors as a measure, publication as a measure and citations as a measure. He concluded that a considerable progress has been made to produce workable indicators; and he emphasized the importance of being positive with respect to the measures. He stressed this point because "too often one sees scientific communities, particularly in countries with only a recent scientific tradition, where whatever funds are in fact spent on science are never followed up by such a functional evaluation of the quantitative measures surveyed in this article, together with various peer evaluation techniques involving, if needed, international scientific manpower, are essential for such a continual assessment of the quality of scientific work."

(Nicholas and Ritchie, 1978).[4] as it is well known, that bibliometricians are interested in the interaction between the literatures of various countries, languages and subjects. The wide growth of literature and rapid development of literatures generated several evolutionary research studies. Hence here, in this chapter, we are going to survey and cover the studies concerned with the literature on scientometrics / bibliometrics.

(Garfield 1979 a)[5] has given a comprehensive discussion on the use of citation analysis to rate scientific performance and the controversy surrounding it. As he mentioned in his paper that the general adverse criticism that citation counts include an excessive number of negative citations, thus, the citations to incorrect results, worthy of attack, self-citations, which indicates that citations to the works of the citing authors, and citations to methodological papers are analyzed. Included are a discussion of measurement problems such as counting citations for multi-authored papers, distinguishing between more than one person with the same last name, such as, homographs, and what it is that citation analysis actually measures. He concluded that as the scientific enterprise becomes larger and more complex, and its role in society more critical, it will become more difficult, expensive and necessary to evaluate and identify the largest contributors. He indicated that, when properly used, citation analysis can introduce a useful measure of objectivity into the evaluation process at relatively low financial cost.

(Mulchenko et-al 1979)[6] have studied the comparative analysis of the information activities of leading scientists that has been carried out. This had included the five previous Soviet chemists, five foreign ones, and eight of the then Soviet physicists, specialist in low temperature physics. Within chemists there has appeared a tendency to a new form of scientific activities, namely ephemeron teams which favor the production line mode of getting new information. In physics, the traditional scheme is preserved: leading scientists publish few articles and have few co-authors. They reported that the ephemeron teams produce expanding information: new objects and processes are studied from the previously elaborated point of view. They have observed that the specific average citation rate (number of references per number of papers) is a criterion for separating the publications of the intellectual industry from the pilot studies full of novel ideas.

(Small and Crane, 1979)[7] studied the technique of co-citation cluster analysis as applied to a special three-year (1972–1974) file of the Social Sciences Citation Index. They used an algorithm which is devised for identifying clusters that belong to a discipline based on the percentage of source documents which appear in a disciplinary journal set. Clusters in three disciplines (economics, sociology and psychology) are identified using this algorithm. Clusters in a specialty of natural science (particle physics) obtained from the 1973 Science Citation Index are compared and contrasted with the three groups of social sciences clusters. Certain common structural characteristics of the social science and natural science groups suggest that knowledge is developing in parts of the social science disciplines in a manner similar to the natural sciences.

(Haitun, 1982)[8] have explained in his paper that the stationary distributions, namely, distributions involving no time dependence, are considered. It is shown that all these distributions in scientometrics can be approximated by the Zipf distribution at high values of variables. The sample moments appear to depend significantly on the sample size. Accordingly, the approximation of these observational data by probability distributions converging to a stable distribution different from the normal, one proves to be the only correct approximation. In conclusion, he formulated that the use of non-Gaussian statistics is necessary in the science of science and other social sciences.

(Arunachalam and Garg, 1985)[9] their well-studied paper gives us an opportunity to the performance of a small and developing country similar to our study, in which they have explained an analysis of 258 papers published from Singapore and covered in Science Citation Index of 1979 and 1980 indicates that (i) much of Research and Development in Singapore pertains to medical research, (ii) almost all the papers are published in English language periodicals published from the western

world, (iii) nearly two-thirds of Singapore's publication output is accounted for by the University of Singapore, and (iv) by and large papers from Singapore are rarely cited, even if many of them have appeared in journals having impact factor greater than one.

(Sengupta, 1985)[10] studied the enormous growth of biophysical literature that has created great difficulties in tracking out the significant literature of the subject. To cope with this unprecedented growth of literature, a new bibliometric technique has been applied to rank periodicals in the field based on 4228 citation data, collected from the bibliographic data base published in the source journal namely, Annual Review of Biophysics. This list is expected to reflect the impact of literature on the advancement of knowledge in the field of biophysics. A striking feature of the ranking list is the high positions occupied by multidisciplinary science journals and biochemical journals as compared to journals exclusively and specifically devoted to biophysics or any particular aspects of it. Other remarkable findings are the wide scatter of biophysics literature; dominance of the USA journals and status attained by English as the preferred medium of communications of the working biophysicists. The data are also analyzed according to subject categorization of the ranked periodicals. He has put forward the results of the present study that have been discussed in relation to Bradford's Law of Scattering and validity of the extension of the law. He has come to a conclusion that It is expected that the present ranking list will enable the working biophysicists to select journals from the viewpoint of their significance to the active areas of present-day biophysical research.

(Small et al, 1985)[11] in their most referred paper depended on their previous attempts to map science using the co-citation clustering methodology and analyzed their shortcomings. Two enhancements of the methodology presented in Part 'I' of the paper-fractional citation

counting and variable level clustering are briefly described and a third enhancement, the clustering of clusters, is introduced. When combined, these three techniques improve our ability to generate comprehensive and representative mappings of science across the multidisciplinary science citation index data base. They have drawn the results of a four step analysis of the 1979 science citation index. The resulting map at the fourth iteration is described in detail. The map shows a tightly integrated network of approximate disciplinary regions, unique in that for the first time links between mathematics and biomedical science have brought about a closure of the previously linear arrangement of disciplines. Disciplinary balance between biomedical and physical science has improved, and the appearance of less cited subject areas, such as mathematics and applied science, makes this map the most comprehensive one yet produced by the co-citation methodology. Also he had gone through the remaining problems and goals for future work which are discussed.

(Schubert and Braun, 1986), [12] in their research paper have studied the cross-field comparison of scientometric indicators, severely hindered by the differences in publication and citation habits of science fields. However, relating publication and citation indicators to proper field-specific reference standards, relative indicators can be built which may prove rather useful in the comparative assessment of scientists groups, institutions or countries. They stressed that the use of relational charts in displaying the indicators broadens the scope of such assessments. In their findings which have mentioned that the relative indicators of chemistry research in 25 countries are presented as an illustrative example and these may help the researchers in new and also further studies.

(Ungern-Sternberg, 1995)[13] in her paper has studied the recent discussions of library and information science (LIS) educators, reducing

heterophony, the lack of similarity between two groups or individuals, among LIS researchers and practitioners has been emphasized. Two researchers with different backgrounds, one in bibliometrics and the other in case study, have observed and discussed applications of bibliometrics and case study as used in teaching research methods. The main thrust is in providing tools for teaching these research methods so that the gap between research and practical application could be narrowed. She explained the paper of Leena Siitonen that discusses the applications in teaching case study research methods. She emphasized that the bibliometrics methods are seldom used by librarians in practical work. Still these methods grow more important when planning information provision in research libraries. New subject fields develop and the numbers of interdisciplinary publications have during the last decades grown exponentially. It is, though, difficult to organize information in new fields, when the classification systems, used 'f' or instance by journal services, have a discipline based structure. The needs to organize this information and help the user to identify relevant documents grows more important, and at the same time the huge amount of available documents give great possibilities to apply bibliometrics easily and in the frame of practical work. Bibliometrics provide a tool for getting the core for developing a local collection in a new field. Teaching bibliometric methods could be developed by: (i) Seminars, where the students learn the methods and also learn to interpret their results by comparing with other studies and (ii) by use of online systems which give good bases for different bibliometric methods.

(**Amudhavalli,** 1997)[14] in her article deals with specific aspect of the subject area of evolution and applications of scientometrics and Informetrics. The author has pointed towards the basic and uncontested beliefs in science studies are the assumption that: "The knowledge of scientific literature has been augmented by a considerable body of

statistical research. This has been directed towards various phases of scientific communication, but has sought principally to describe the characteristics of the literature available to scientists to identify the literature required by them or to determine how they use the literature". She referred the three terms 'bibliometrics, scientometrics and Informetrics' without going through their differences. She concluded that: "This historical account confirms that the contemporary approaches in 'Scientometrics'/'Informetrics' are marked by extensive use of quantitative and qualitative techniques. In recent years, such quantitative methods are being extensively used for studying the structure of literature (of discipline). These techniques have been helpful in enabling the mapping of disciplines as also a study of any transition in the structure and composition of a discipline. In fact, in the last one decade a number of tools, techniques and indices for this purpose have been developed and applied to various areas".

(Jalaja, 1997)[15] has studied the bibliometric analysis of Journals which are related to science subjects and subsequently published in India. The objectives of this study were to identify a list of core Indian journals in Mathematics, Physics, Chemistry etc. and to study the scattered patterns of literature related to science subjects. Also to determine the authorship in these subjects and to find the similarity of earlier studies as well as to find out whether foreign authors are interested in publishing their research studies in the Indian Journal of science. The methodology of his study is based on the abstracts which are published in the secondary journals. He used document analysis. Preparations of frequent distributions and calculation of percentage, graphical representations and statistical analysis. Many major findings are drawn from his study. For further research, he has suggested the followings:

(i) Research studies aiming at identifying core journals, prominent journals and insignificant journals in area other than science and technology should be taken up.

(ii) The data for the present study was gathered solely from Indian Science Abstracts, more comprehensive studies on the basis of data obtained from other sources should be undertaken to supplement the finding arrived at in this study.

(iii) In order to verify whether some of the deviations from the established laws of bibliometrics are noticeable in this study, similar studies need be conducted.

(iv) Studies giving more stress to the bibliometrics of patents, standards, etc. need to be carried out.

(Leydesdorff and Besselaar, 1997)[16] in their paper explain the theory of citations, laying emphasis on the fact that should not consider cited and/or citing agents as its sole subject of study. Since one is able to study the dynamics in the networks of communications. While communicating agents, for example, authors, laboratories, journals, can be made comparable in terms of their publication and citation counts; one also would expect the communication networks not to be homogeneous. They observed that the latent structures of the network indicate different codifications that span a space of possible translations. They explained that the various sub-dynamics can be hypothesized from an evolutionary perspective. They have discussed using the network of aggregated journals and journal citations in science and technology studies as an empirical case, the operation of such sub-dynamics can be demonstrated. They concluded that the policy implications and the consequences for a theory-driven type of scientometrics will be elaborated. But Leydesdorff, in his book has identified some challenges of scientometrics and suggested that: "the state of the art of science studies is 'pre-paradigmatic': it is an

interdisciplinary area integrated only at the level of its subject matter, and an application area for various contributing discipline." (Leydesdorff, 2001).

(Raan, 1997), [17] in his well studied paper has analyzed the state of the art of scientometrics and characterized its application-oriented tradition. He argued that the core research activities of scientometrics fall in four interrelated areas: science and technology indicators, information systems on Science and Technology, the interaction between Science and Technology and cognitive as well as socio-organizational structures in science and technology. He has emphasized that an essential condition for the healthy development of the field is a careful balance between application and basic work, in which the applied side is the driving force. In other words; scientometrics is primarily a field of Applied Science. This means that the interaction with user is at least as important as the interaction with colleague-scientists. He states that this situation is very stimulating, it strengthens methodology and it activates basic work. He has considered an idea of scientometrics lacking theoretical content or being otherwise in a crisis-like situation groundless. He observed that scientometrics is in a typical developmental stage in which the creativity of its individual researchers, the climate and facilities of their institutional environments determine the progress in the field and, particularly, its relation with other disciplines. He has cleared discussion on these aspects also contribute substantially to the reputation of scientometrics as a research field respected by the broader scientific community. He emphasized that the latter point is important; both to let quantitative studies of science and technology take more advantage of an academic environment, as well as to keep it innovative and thus attractive in terms of applications at the longer term. He envisaged that scientometrics could benefit significantly from a greater integration with knowledge discovery and data mining.

(Rios, 2000)[18] studied the incipient presence of the bibliometrics in the University of Argentine, Brazil, Paraguay, Uruguay (MERCOSUR countries) Bolivia and Chile. It is important to denote the circulation of specific bibliography of local authors mentioned in the catalogues of university libraries. Taking into account the available documentation, scientific research that applies the methodology and techniques of the bibliometrics is found in the field of biomedical libraries and it is scarce in the Humanities libraries. In his country (Argentine), if the tendency of using computers during the last few years continues, the quantitative treatment of the information and documentation will be easier and the bibliometrics will be a basic instrument. He concluded that besides teaching and application of the bibliometrics, it is important to develop wide and comprehensive database that was the main obstacle normalized and indexed in Spanish language and of easy access through the new telemetric technology. Otherwise, it is observed that the bibliometric investigations appear vitiated from their origin.

(Garcia's, 2001)[19] describe bibliographic references in Spanish nursing research papers and their evolution over a decade. He has used the method that consists of a retrospective bibliometric study of a cluster sampling of 622 research original and review papers, which were contained in the Spanish nursing journals Enfermeria Cientifica, Revista ROL de Enfermeria, Enfermeria Clinica and Enfermeria Integral, and published from 1985 to 1994. The journal Nursing Research was selected for qualitative comparative purposes. A series of classic bibliometric indexes were used. The results of his study show that the mean of references per paper is 10-64 ± 10-42; this increased over time ($P < 0.001$). Review papers have more references ($P< 0.001$). Price index (percentage of references published during the last 5 years) is 44% and the Insularity (percentage of references published in same country as the article) is 55%. References to journals predominate (58-6%), with a growing tendency for references to Spanish nursing

journals, although they are still scarce (181% of the references to journals). Spanish is the language of most of the references (60-3%), the second language being English (36-1%). He concluded that the bibliographic references in Spanish nursing research papers are scarce and not very specific: this happens both in regard to Nursing Research and to publications in other national science areas. However, there is an increasing tendency of references to nursing journals in the period analyzed. He indicated that the age of the references places Spanish nursing in an intermediate position between the hard sciences and the humanities: and, according to the type of documentation used, we find it halfway between experimental and natural sciences, and technologies and social sciences. A clearly observed concluded remarks that there has been a slight increase in references in English in recent years.

(Chen et al, 2003)[21] focused on issues concerning how effectively they investigate an integrated approach to scientometric studies with emphasis to the use of information visualization and animation techniques. Their study is based on bibliographic data derived from the web of science that draws upon citation and co-citation patterns derived from articles published in the journal Scientometrics (1981-2001). In their paper they shows the modeling, visualization takes an evolutionary and historical perspective. In their study, they adapted an integrated procedure of citation analysis and the design of the visualization model adapts a virtual landscape metaphor with document co-citation networks as the base map and annual citation rates as the thematic overlay. The study explains that the growth of citation rates is presented through an animation sequence of the landscape model. Issues concerning the visual-spatial design are discussed from a citation analysis point of view. Spain is one of the few European countries to have incorporated the study of nursing into the university sector. Also they mentioned that the bibliometric studies may be of a great help for the consolidation of nursing research. They concluded

that the long-term research has to continue to pursue visualization-augmented approaches to scientometrics studies.

(Wilson and Osareh, 2003) [21] showed their concern with the classification and specially the indicators of mapping of science and technology (S and T) field in developing countries and with specific reference to Iran. They compared the funding of research and development (R and D) in Iran with the scientifically advanced countries and found that funding from private sector is negligible and the government expenditure on Research and Development is merely 0.5%. They searched the Science Citation Index using the dialog information system to obtain information on all types of publication form 1975 to 2002 from worldwide and Iran. They tried to obtain reliable and consistent Science and Technology indicators for Iran: "to provide dependable methods of measuring scientific activity in terms of the production of scientific publication....Scientometrics, the quantitative study of science and technology through its published literature, uses various Science and Technology databases to show, inter alia, a country's share of the world's total publication count". Also they mentioned the limitations of the scientometric approach as bibliometric and Informetrics data are likely to under represent the level of international collaborative research in their discussion of international collaborative research. They concluded that Iran's published output in Science and Technology reflected the turmoil and hardship the country was undergoing with sharp decline in the 1970s and 1980s. However, from 1990 to 2002, they observed that the Iranian publications hare risen tenfold. In many Iranian universities, small staff numbers combined with heavy teaching responsibilities make it difficult to pursue a vigorous research agenda or to develop areas of specialization. Equipment is often a problem. Adequate as it is often inadequate for state of the art research. Under these circumstances, it is to Iran's credit that scientists have been able to gain international presence in

several field of specialization. But for Iranian scientists to attain more prominence in the future, policies must be devised not only to promote the education of talented young people but also to create broader channels of communication with the international scientific community.

(Coronado et al, 2004)[22] His study is concerned with southern European less-favored region of Andalusia that have allowed to design its own Research and Development policies that complement those implemented throughout Spain and the European Union. Recently the Regional Government passed the Third Andalucian Research Plan 2000-2003. Their paper provides deeper insight into the role played by science in driving the technological development of Andalusia. The aim of the paper was to answer five fundamental questions: how is basic science utilized by industry and Andalusia? Which sectors are the most dynamic in the employment of scientific know how? Which scientific fields are mostly in demand by industry? Which types of institution utilize scientific knowledge most profusely? What delay is there in incorporating science into technology? The methodology which they have applied for investigating the links between science and technology is based on scientific situations in patent documents (NPC). The results of their study provides relevant information about the interconnections of scientific and technology systems and thus constitute a good point of reference for the development of future Research and Development plans.

(Shabana, 2004)[23] has studied literature on brain injury on data collected from volumes of index medicus 2001-2002, by using bibliometric techniques for eliminating low-quality literature and selected a small portion of significant, reliable and relevant high quality publications. She analyzed and interpreted the data and applied the bibliometric laws to check the validity of these laws. Her study proved that Bradford's law of scattering is significantly applicable. But she came

to conclude that: "the trends of research now a days have changed as compared to the period when Lotka's law was formulated. At present inter-disciplinary method of research are common and most of the articles are now written in Joint authorship on the basis of analysis of the present data. It was, thus, difficult to testify the validity of Lotka's Law". The study also proved that Zipf's law is valid and still used even today.

(Kretschmer and Thelwall, 2004)[24] studied that the development of information and library sciences together with science studies will, among other things, be fashioned by the development of quantitative studies conducted in this field. The terminology thus obtained shall be perceived as a reflection of the technical, social and political backgrounds of the researchers. The technical redevelopment of methods of communication through the Internet presents a challenge for information scientists to cultivate novel quantitative methods and techniques in order to measure rates of information exchange in this new medium.

(Lars and Lilja-Karlander, 2004)[25] identify the study designs and topics of Swedish orthodontic articles, to elucidate their international position, and to verify in which scientific journals the articles had been published in the past decade. A search of the Medline database for papers published between 1992 and 2002 was made using the medical search heading terms (orthodontics, malocclusion, cephalometry), and (facial bones and growth). Two independent reviewers selected the articles of Swedish origin and categorized each article according to research design and principal topic. Overall, 15,572 articles in orthodontic research were found, of which Swedish contribution was 1.9% with the majority of these (71.5%) being submitted by universities. Most of the Swedish articles (84.5%) had been published in ten journals and many high-quality studies with orthodontic interest were published

in non-orthodontic journals with higher impact factor scores than the orthodontic journals. Every second study was a prospective one and of these (5.2%) of all Swedish articles were randomized clinical trials. The findings of their study have come along with that neatly every third study, prospective as well as retrospective was uncontrolled. The main classification was treatment studies (51.9%), followed by development (18.6%) and diagnostic information (10.7%) studies. Thus, they have come to conclusion that the majority of the articles evaluated therapeutic interventions. However, although the randomized clinical trials are the preferred study design in evaluation studies, few used this method. In an era focused on evidence-based medicine, studies with randomized clinical trials design will be the future challenge for research in the field of orthodontics.

(Prasad and Chaturvedi, 2004)[26] studied the digital divide and role of health science libraries in India. They observed that due to proliferation of electronic sources and networks, the amount of information and the complexities of information sources are more than most clinicians and students can cope with. Also the plethora of information on the Internet, much of it unorganized, unevaluated and potentially dangerous if improperly utilized, necessitates acquiring more sophisticated information handling skills and searching techniques for libraries. It is a challenge to which hospital librarians with their expertise in managing information and the awareness of their user's need, can and must rise. Therefore, technology will continue to change, and libraries and librarians will continue to change, and libraries and librarians will use the changing technology to provide the best access and service to their clientele

(**Senthikumaran and Amudhavalli,** 2004)[27] presented a comparative report on India and Japan in terms of their publication output, the priorities they have assigned to different fields in Spices

research during the last three-decade using Hort-CD Database. They concluded that Asia is not only a major continent in the world, but also is found to be one actively engaged and has been expanding in R&D output over the years as there has been a steady increase in its productivity pattern in Spices Research. Hence, Asian countries are the major producers, marketers, and consumers of spices in the world. India being one of the ancient and acclaimed Asian countries in spices and hailed as the "Home or Land of Spices". India's output of research in the field of Spices Research is found to be considerably more than the Japanese output. However, qualitative analysis indicates that Japan (101%) publishes more papers in the field in relation to its total output than average in the field of Spices that India (94%). Attempt to establish the priorities for R and D on Spices by these two countries reveals that both India and Japan publishes more on the 'MAJOR' category of spices. It is inferred that India needs to review its performance in the Spices R&D. The difference in the AI factor through is very marginal – 4%. It is also to be noted that India's AI has a gradual declining status, which has to be taken seriously by the policy-makers and researchers in this field. Spices research Institutes in the country has to reconsider its aims and roles.

(Aguillo and Krestchmer, 2005)[28] demonstrated the manual analysis of hyperlink network between personal homepages of the German society for psychology and on the one hand the number of personal and institutional web pages is increasing enormously during the last two decades but on the other our knowledge about the background is low. The present paper comments about creation of personal web pages in academia and research as well as about linking between these pages. In this connection, different methods of sampling personal and institutional web pages as also link analysis vis a vis manual analysis.

(De Castro, 2005)[29] the paper is concerned with a scientometric evaluation. Of the outputs of PADCT (Program de Apoioao Desenvolvimento Cientifico e Tecnologico) and stimulate scientists, policy-makers generally as to how reliable are scientific investments made by developing countries on long-term basis? He highlighted the experience of developing countries, particularly; in Latin America that successful scientific initiative may be discontinued due to political influence. His study discussed the scientific strategies and results of a scientometric evaluation of the Brazilian PADCT as a case study. He used the sample methods to postulate the possibility of evaluating science and technology (S and T) programme by the performance of the researches funded by the programme and compare the output with the performance of researchers from other countries. He used methodology for bibliometric analysis for a scientific field for the future use by the Brazilian Ministry of Science and Technology. In other studies, a data set includes the following elements: (i) a full bibliographic listing for papers (ii) all addresses information appearing with the publication, (iii) a scientific field classification for each article based on a system devised by ISI and based on the journal publication (iv) records of all citations to each Brazilian paper by the year of citation, and (v) records of expected number of citations to each Brazilian paper. The results of his study presented that 44 out of 49 fields show an up trend in the last final three to five yeas. He concluded that: "Scientific Indicators data presented in this article shows that Brazil increased significantly its overall performance in Science...scientists funded by PADCT II, achieved high levels of scientific performance during the period of 1992-1996, compared to previous periods when funds of PADCT were not available. This method can be applied to qualitatively evaluate scientific outputs of programs and institutions, and will be useful particularly for developing countries".

(**Nicholson,** 2005)[30] this paper looks at the integration of data mining in digital library services. First, bibliomining, or the combination of bibliometrics and data mining techniques to understand library services, is defined and the concept explored. Second, the conceptual frameworks for bibliomining from the viewpoint of the library decision-maker and the library researcher are presented and compared. Finally, a research agenda to resolve many of the common bibliomining issues and to move the field forward in a mindful manner is developed. The result of his study is not only a roadmap for understanding the integration of data mining in digital library ser-vices, but also a template for other cross-discipline data mining researchers to follow for systematic exploration in their own subject domains.

(**Yue and Zeyuan,** 2005)[31] showed that the collaboration in scientific study plays an important role in science and humanity. The object of the study is to correlate collaboration in China with Management Science. Based on the Chinese Journals Full text Database (CJFD), we conducted a quantitative analysis of the authorship rate with the published time, the age group and address sources of the authors. The analytical results indicate that the scholars and younger scholars of the age group of 30 years are the new blood. Chinese cities could be categorized to different grades according to the analytical results of the address sources of the authors. Beijing and Shanghai are the first grade cities, which mean that they are the national centers in Management Science; Xi'an, Wuhan, Nanjing, Tianjin, Hangzhou and Shenyang are the second grade cities, which are the mid-collaboration level cities and the regional centers in management science; the rest are placed in third grade.

(**Bollen and Vande Sompel,** 2006)[32] have stated that Science has traditionally been mapped on the basis of authorship and citation data. Due to publication and citation delays such data represents the

structure of science as it existed in the past. They proposed to map science by proxy of journal relationships derived from usage data to determine research trends as they presently occur. Their paper states that mapping is performed by applying a principal component analysis superimposed with a k-means cluster analysis on networks of journal relationships derived from a large set of article usage data collected for the Los Alamos National Laboratory research community. The Results of their study indicate that meaningful maps of the interests of a local scientific community can be derived from usage data. Subject groupings in the mappings correspond to Thomson ISI subject categories. A comparison to maps resulting from the analysis of data reveals interesting differences between the features of local usage and global citation data.

(Sangam et al, 2006)[33] portrayed a scientometric study of Professor Ramachandran who worked in various fields in anomalous scattering, and the phase problem, the analysis of the structure of fibres, and the conformational analysis of macromolecular structures. They stated that, Ramachandran is considered to be one of the founders of the rapidly developing field of molecular biophysics; his contributions are mainly to the theory of molecular structure of biopolymers in relation to their biological activities. In his 49 years of productive life, he has collaborated with 81 colleagues and students and has published 304 papers during 1942-1990. The highest collaboration coefficient is 0.86. He has the highest collaboration with Sasisekharan (18) and Srinivasan (15). The core journals, which published his papers were: Proceedings of the Indian Academy of Sciences, Acta Crystolographica, Current Science, Nature and Biopolymers. They concluded that Ramachandran was undoubtedly one of the most outstanding scientists of post-Independence India and truly a jewel in the crown of India's science.

(Albert et al, 2007)[34] have studied the evaluation of the Spanish CSIC performance in Biotechnology, as compared with those of the French CNRS and the Italian CNR. It has been carried out to determine the balance between the generation of scientific knowledge and the transfer of technology. Their study shows a high scientific productivity mostly in journals with moderate impact factor, a low generation of patents and an insufficient transfer of knowledge to the Spanish companies. Other indicators confirm the existence of competitive human resources in biotechnological research producing scientific knowledge of interest for the development of patents and that cooperates successfully at European level.

(Gian Singh, Rekha Mittal & Moin Ahmad, 2007)[35] have undertaken this study to find out the growth and characteristics of digital library literature. They approached over 1,000 articles for the period 1998-2004 from LISA Plus and these article were analyzed to study authorship patterns authors productivity and prominent contributors, language-wise and year-wise distribution of articles, country-wise distribution of journals, core journals in the subject area, and indexing term frequency.

(Gupta and Dhawan, 2007)[36] investigated role and contribution of various performing sectors in Indian physics out put. The objective of their paper is to study and analyze the overall performance of four major performing sectors, namely universities and colleges, mission oriented Research and Development, institutes of national importance, and industry, in physics research in India during 1993-2001 in terms of publication growth and output and publication impact, using a number of quantitative indicators. The second part of the paper provides data on comparative analysis of the performance of various sectors participating in physics research in India.

(Kretschmer and Kretschmer, 2007)[37] presented that a fairly large number of publications in sociology, in computer science or in information sciences, as well as in studies of collaboration in science deal with the studies of social networks with unweighted ties because measures involving unweighted ties are easier to calculate. A few studies on networks with weighted ties have been conducted. Such studies not only need more complex formulas but also a process of quantification especially when quantitative empirical data are not directly available. The later are, however, directly available under the condition of using bibliometric or webometric data. Consequently, new complex measures of the degree centrality are introduced including weighted ties possible for use of the analysis of co-authorship or citation networks. Both co-authorship relations and citations are well-quantified data.

(Looy et al, 2007)[38] in their paper, which is one of the latest well-studied work in the field of scientometrics in which they investigate, at a country level, the relationship between the science intensity of patents and technological productivity, taking into account differences in terms of scientific productivity. They observed that the number of non-patent references in patents is considered as an approximation of the science intensity of technology whereas a country's technological and scientific performance is measured in terms of productivity (namely, number of patents and publications per capita). In their paper, they have used USPTO patent-data pertaining to biotechnology from twenty countries, covering the time period 1992–1999. The findings of their study reveal mutual positive relationships between scientific and technological productivity for the respective countries involved. At the same time technological productivity is associated positively with the patients. They have done their investigation and confirmed these results when introducing time effects, they have informed that these observations corroborate the construct validity of science intensity as a distinctive

indicator. They suggested its usefulness for assessing science and technology dynamics, in today's most complicated practical life of science and technology.

4.3 ARABIC LITERATURE REVIEW:

(Al-Samaraee, 1995)[39] utilized intellectual output to get the reality of the Iraqi intellectual out put and performs a bibliometrics analysis of the literature in the field of media for the period from 1968 to 1988 through countless and formal analysis, objective timetable to identify features and stages of growth and productivity analysis weakness and composed to identify the most productive field. The study reported steady growth of media literature in Arabic language related to Iraq in a number of periodical titles. She applied the bibliometrics laws to the published out put. The results of her well-studied research showed that the media literature grew tremendously during the Iraq-Iran war (1980-1988) due to the war propaganda, there was increase in media during the war period. She shows the out put of her study results as follows: (i) inventory subject distributed among 264 books, 514 articles and 44 theses, (ii) resulting in turns intellectual upward and (ii) superiority of media in the number of what had been written followed by press, so as to the importance . Her study encouragement entrusts the joint formation between the authors and necessity releasing his of winner scientific specialized in the domain, added him to encouragement of the product the translator for the custom from during him on cultures of the people.

(Al-Zubaidi, 1995)[40] examined the scientific literature in Library and Information Science by analyzing citation patterns of many journals and books. In his study, he sorted out citations based on the subject category of referencing and systematically reviewed cases in many journals and books. The results of his study showed that it is only after the opening the department of studies in Library and Information

Science in 1978, the number of post graduate candidates increased, and which calculated in increasing the published output on the subject in Iraq also observed that more and more intellectual output of publication took place during the war time (1980-1988) observed that only few bibliometric works were investigated in separate fields in the early years. No study had been conducted on the Iraqi literature that encompassing in library and information science.

(Abdul-Lateef, Muna, 1998)[41] has done a bibliometric study on the Saudi Arabian agricultural research. The objective of her paper was to analyze the citation references of the Arab researchers in the field of Agriculture published in the magazine of the Agricultural Science issued by King Saud University, cover up a period from 1989 to 1994. The concerned magazine has so published 12 volumes and carries 206 research articles. In this well-studied paper, she has applied statistical techniques. She adopted an integrated procedure of citation references analysis of Arabic literature. The results showed that out of a total of 2991 references 535 cited Arabic references 18.18 per cent as against 2,456 81.82 per cent in English and a few in French, German and others. That means the Arab researchers mostly prefer to cite in foreign languages than in Arabic.

(Ghunaiyem, 1998)[42] in his paper study is the Egyptian intellectual output in the filed of Education in Arabic as well as in other languages. The material included translated or authored books, periodical articles, research papers or thesis covering a period from1950 to 1990. In the four decades, lot of Scientific researches in the field of Education and Psychology were conducted in Egypt. He has selected 22 sections for investigation. The method of his bibliometrics study is a descriptive explanation of data and then analyzing them; and he applied the quantitative techniques, taking Bradford's law for analyzing the citations references.

(A'alyan, 2003)[43] studied and analyzed statistically the status of book publishing movement in Jordan during the period (1980-2000) as controlled by the Jordan national Bibliography of that period, It also aims at answering several questions related to the number of books published during that period, their languages, place of publishing, nature of responsibility (author, translator, editor, etc.) editions, and number of pages. The results of the study show that 1,173 books were published in Jordan during that period, with an average of (558.6) book annually. The number of books published yearly ranged from 221 books in 1980 to 737 books in 2000, 94 per cent of total books were published in Arabic. The majority to the books were in Social Sciences (24.68 per cent), followed by Literature (22.57 per cent) then Islamic Religion (13.7per cent). The least number of books were in Fine Arts (2.39 per cent), Philosophy and Psychology (1.46 per cent). The majority of the books were published outside Jordan 94.95 per cent of the books were issued in one edition. The results show that 18.7 per cent of the published books were issued in less than 100 pages, and 37.2 per cent exceed 200 pages, and 7.8 per cent exceed 400 pages. The study ends with some recommendations that may help in developing book publishing movement in Jordan.

(Al-Fadli, 2005)[44] in his investigation to the published output of Sana'a University (Yemen) during 1976-2002, has used statistical techniques for the bibliometric analysis. The source literature included books, Scientific Periodicals and Research works (dissertation, thesis and papers). The objective of this study was to answer many questions, such as, how many intellectual outputs were conducted during the 34 years? What is percentage of annual growth? What are the most important subjects in which researches were done and finally published? What is ratio of books, published in English and in Arabic? What sorts of problems are faced by the university with regard to publications and other students related research work, he used many

methods of study in his research paper for bibliographical analysis. It included descriptive measures and also for quantitative analysis empirical laws. He highlighted the reasons behind the less number of authors/researchers from Sana'a University. The results of his study show the share of the university publication is very poor and without any planning or scope of view point towards the scientific research due to recruiting of the government administrators is the biggest impact and drawback that put the university in the step of backward and darkness, specifically for the scientific publication purposes and they never care about the position of the library lastly, the discouraging atmosphere to teaching staff on scientific research work in his study's solution and recommendation, he put forward that the university should take care and concentrate in the educational and academic needs and achieving its goals and ambition among them the scientific research and university publication. Also he highlights that university should encourage the faculty staff members, students and researchers through better remuneration.

4.4 CONCLUDING REMARKS:

The foregoing review of related literature is not an exhaustive survey of the literature and findings of empirical work that has gone into this area. However, it does provide analytical framework for enabling us to undertake the present study.

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Chapter Five

Scientometrics / Bibliometrics laws

CHAPTER FIVE

SCIENTOMETRIC/ BIBLIOMETRIC LAWS

5.1 INTRODUCTION AND HISTORICAL BACKGROUND

Communication is the exchange of information between individuals by means of a common signal system. Scientific communication can be defined as the combined processes of presentation, delivery and receipt of scientific information in human society. To study scientific communication, techniques and measures are needed. The family of techniques used to identify relationships in the published literature is collectively referred to as "Bibliometrics".

Bibliometrics is the generic term used to describe indicators to measure the output of scientific and technological research through data from scientific literature and patents.

Bibliometric data enables us to explore trends, both within a country and worldwide, as well as track patterns of collaboration among countries, institutions and among individual researchers. It provides information such as: trends of a country's share in the worldwide activities in science and technology, 'impact' of a country in the scientific community (national and international), information on international collaboration, international programmes, and the structures of scientific disciplines and their relations with others, etc.

The word "Bibliometrics" first appeared in print in 1969 in Alan Pritchard's article "Statistical Bibliography or Bibliometrics?" (Pritchard, Alan,1969)[1] Pritchard's article was the result of his judgment that the expression "statistical bibliography" should be replaced with a better

term. The term statistical bibliography is clumsy, not very descriptive, and can be confused with statistics itself or bibliographies on statistics. Pritchard suggested that the word "BIBLIOMETRICS, i.e. the application of mathematics and statistical methods to books and other media of communication" be substituted for "statistical bibliography".

The term 'Bibliometrics' is a combination of two non-English words, that is, 'biblio' and 'metrics'. The first 'biblio' is derived from the Greek/Latin word biblion, which means book, While the other word 'metrics' indicates to the science of meter, that is, measurement. The later has also been adopted from a Greek/Latin term 'metrics' or 'metrikons', both having the same meaning (Webster's, 1981)[2]. Therefore, bibliometrics is adopted into English and connotes the science of measurement pertaining to books, research papers, journals or any sort of documents.

Alan Pritchard, who first used the word "bibliometrics," described it as the "application of mathematics and statistical methods to books and other media of communication" (Pritchard, Alan, 1969)[3] This was paraphrased by Robert A. Fairthome as 'quantitative treatment of the properties of recorded discourse and behavior appertaining to it. In a later article, "Bibliometrics and Information Transfer," Pritchard explained bibliometrics as the "metrology' of the information transfer process and its purpose is analysis and control of the process. He based his interpretation upon the fact that measurement is "the common theme through definitions and purposes of bibliometrics" and the things that we are measuring when we carry out a bibliometric study are the process variables in the information transfer process. (Pritchard, Alan. 1972)[4]

The British Standard Glossary of Documentation, of Terms explained bibliometrics as the study of the use of documents and patterns of publications in which mathematical and statistical methods have been applied, (British Standards Institution 1976)[5] definition is basically the same as Pritchard's original definition.

William Gray Potter, editor of the issue of Library Trends devoted to bibliometrics, followed suit with "bibliometric is simply put, the study and measurement of the publication patterns of all forms of written communication and their authors. (Potter, W.G.,1981)[6] In the same issue, Alvin M. Schrader said it even more simply, "Bibliometrics, is the scientific study of recorded discourse. (Schrader, A.M., 1981)[7].

Bibliometrics, called a quantitative science, is divided into two areas, descriptive and evaluative.

In one of these classes is included the study of the number of publications in a given field, or productivity of literature in the field for the purpose of comparing the amount of research in different countries, the amount produced during different periods, or the amount produced in different subdivisions of the field. This kind of study is made by a count of the papers, books and other writings in the field, or often by a count of those writings which have been abstracted in a specialized abstracting journal. The other includes the study of the literature used by research workers in a given field. Such a study is often made by counting the references cited by a large number of research workers in their papers.

The two areas may also be divided as follows:

1. Productivity Count (descriptive)

a. Geographic (Countries)

b. Time periods (Eras)

c. Disciplines (Subjects)

2. Literature Usage Count (evaluative)

a. Reference

b. Citation (Stevens, R. 1953)[8]

Nicholas and Ritchie divided the two groups as "those describing the characteristics or features of a literature [descriptive studies] and those examining the relationships formed between components of a literature [behavioral studies]

Although all the descriptive studies are not evaluations, all the evaluative analyses are first descriptive with the evaluative analyses taking the data one step further, providing "data on the condition or character of the literature as a whole" (Nicholson, David ; Maureen Ritchie,1978) [9].

5.2 DEFINITIONS OF THE BIBLIOMETRICS/SCIENTOMETRICS

(i) (Raising, 1962)[10] has defined bibliometrics as "the assembling and interpretation of statistics relating to books and periodicals. Use of books and journals to ascertain its many local situations the generals use of books and journals".

(ii) (Pritchard,1969)[11] has defined bibliometrics as "the application of mathematical and statistical methods to books and other media of communication", which is the most commonly quoted

definition and it has served as the foundation stone and basis for many investigation.

(iii) According to (Fairthorne, 1969)[12] bibliometrics is the "Quantitative treatment of properties of recorded discourse and behavior appertaining to it."

(iv) (British Standard Institution,1976)[13] defines the term bibliometrics as: "the study of the use of documents and patterns of publication in which mathematical and statistical methods have been applied".

(v) (Hawkins, D.T, 1977)[14] in his on line bibliometric study interpreted bibliometrics as 'Quantitative analysis of the bibliographic feature of a body of literature.".

(vi) (Nicholas and Ritchie, 1978)[15] opined that: "Bibliometrics...Provide information about the structure of knowledge, and how it is communicated." They further added that "bibliometric studies fall mainly into two broad groups – those describing the characteristic or features of a literature (descriptive studies), and those examining the relationship formed between components of a literature (behavioral studies)".

(vii) (Potter, W.G.1981)[16] in his introduction to bibliometrics in Library Trends he has stated that: "Bibliometrics is, simply put, the study and measurement of the publication patterns of all forms of written communication and their authors."

(viii) (Sengupta, I.N, 1985)[17], in his study has covered the meanings of bibliometrics as given by different authorities.

Taking into account all the facts of bibliometrics he defined bibliometrics more explicitly as: "Organization classification and quantitative evaluation of publication patterns of all macro- and micro-communications along with their authorships by mathematical and statistical calculus".

5.3 RELATED TERMS OF BIBLIOMETRICS:

Many sciences and social sciences are ending by suffix metrics and bibliometric is just one of them. Many scientists have been using the term 'bibliometrics' under different names, but the concepts anyway are the same. Some of these well known terms are Psychometrics, Econometrics, Informetrics. Scientometrics and Bibliometrics are closely interrelated where mathematical and statistical calculus have been systematically applied to study the problems of library science (Mahashwarappa, 1997)[18], Some of these terms are described here under:

5.3.1 Scientometrics as a term was first defined and suggested in 1969 by two Russian scholars, namely, Nalimov and Mulchinko, accordingly, scientometrics is a complex of quantitative methods that are used to investigate and study science's process. But scientometrics was introduced and came into prominence with the founding of the journal called "Scientometrics", by T. Braunin in 1977, originally published in Hungary and currently from Amsterdam. On the other hand, the term scientometrics is derived from the Russian 'naukometria' and was used mainly in the East and is defined as the study of the measurement of scientific and technological progress (Egghe, 1988b).[19]

Scientometrics is "the study of the measurement of scientific and technological progress" (Garfield, 1979b)[20] its origin is in the quantitative study of science policy research, or the science of science,

which focuses on a wide variety of quantitative measurements, or indicators, of science at large. Typically input and output of science programs correspond to two major categories of indicators, the first, scientometrics deals mainly with science policy applications, and the second, scientometric research has a strong application-oriented tradition (Garfield, 1979b)[21], (Raan, 1997)[22] For example, scientometric studies may help governments and private sectors, identify their competitive edges, make strategic plans for future research areas and allocate research funding to key research areas, identified several publications appeared in the 1970s and contributed to the development of scientometrics (Garfield,1979b)[23].

5.3.2 Informetrics: this term was suggested by German scientists A. Blackert and S. Z. Zygel in 1982, as a newly formed branch of science. Informetrics studies all quantitative aspects of mathematical, statistical, and probabilistic of information and information flow, including the modeling of library management, in the latter sense, the research area usually is called bibliometrics. Therefore, (Potter, W.G, 1981)[24] states that: "Informetrics is the study of the quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists". We harbour no strong feelings about the vagueness of the term, but would like to ask the following quest: Do chemists and physicists quarrel about chemical physics? Is it important to determine whether a certain paper should be considered as a mathematical paper, an econometric one, or even an economics paper? Every new field has vague boundaries and even established fields such as physics and chemistry cannot be separated in a clear way. So, is not informetrics simply that which informetricians do? Therefore, many library scientists have advocated the use of the term informetrics, a term which takes cognizance of the fact that modern technology has imposed on us new

non-documentary forms of knowledge representation and of its transmission and dissemination.

5.3.3 Librametrics, this term belongs to the family of metrics, the word (Librametry) historically has appeared in the year 1948. The terminology was put forward by the great Indian library scientist (Ranganthan, 1969)[25] He suggested using of mathematical and statistical techniques for the purpose of analyzing the library activities and library resources. As a matter of fact, in developing countries, no body is concerned or bothered about research output, and subsequently, the term 'Librametry' did not take its place in library and information science and was ignored and forgotten for many years, until later on it was rediscovered and called librametrics.

5.3.4 Cybermetrics: Recently, a new growth area in bibliometrics has been in the emerging field of webometrics, or cybermetrics as it is often called. Webometrics can be defined as study of quantitative aspects of webpages or nodes as using of bibliometric techniques in order to study the relationship of different sites on the world wide web. Such techniques can be utilized to map out scientific mapping in traditional bibliometric research areas of the Web that appear to be most useful or influential, based on the number of times they are hyperlinked to other web sites.

5.4 SCOPE AND PURPOSE:

Bibliometrics, which is the application of mathematics and statistical method to books and other media (Pritchard, 1969)[26], has recently drawn the attention of serious researches in library and information science both theoretical and empirical. Theoretically, it is the quantitative features of the properties of recorded discourse. Quantitative characterization is the setting forth of probabilistically true

ideas about selected phenomena. Thus, the objective of bibliometrics as a scientific study is to produce ideas, that is, theory about recorded discourse and its various important properties. Since the practice is always backed by theory, bibliometrics also promises to provide practical knowledge benefits. This brings bibliometrics within domain of a scientific discipline.

The studies of bibliometrics are falling mainly into two groups, one describing the literature features (descriptive studies), and the others examining the relationship of literature, that is known as behavioral studies and sometimes referred to as citation studies. Descriptive studies are more interested in the condition of past literatures, specially in areas where the previous literatures of the on going research studies, are concerned with representing faithfully the characteristics present in the current literature. Behavioural studies are those which confirm themselves to describing the features of a document. Behavioural studies explore the full bibliometrics field and examine the relationships, the nature and strength of each relationship. (Nicholas and Ritchie, 1978)[27].

The pioneer work by (Hulme,1923)[28] entitled "Statistical Bibliography in Relation to Growth of Modern civilization", clearly states the purpose of bibliometrics. Hulme sought to identify the shape and period of movements in the development of science by examining patterns in the literature (Nicholas and Ritchie, 1978)[29]. Pritchard defines the purpose of bibliometrics, "To shed light on the process of written communication and of the nature and course of development of a descriptive (in so far as this is displayed through written communication) means of counting and analyzing the various facets of written communication." (Pritchard, 1969)[30].

Here, we summarize the purposes of bibliometrics as follows:

(i) To shed light on the processes of written communication and of the nature and course of development of a discipline (in so far as this is displayed through written communication), by means of counting and analyzing the various facets of written communication.

(ii) The assembling and interpretation of statistics relating to books and periodicals...to demonstrate historical movements, to determine the national or universal research of books and journals, and to ascertain in many local situations the general use of books and journals.

(iii) To identify and find out forms of literature, as bibliometrics provides a unique identification.

(iv) Preparation of ranked journals and make comparison between them.

(v) To identify the country with a vast and greater literary output.

(vi) To find out the chronological scattering order of all cited literature.

(vii) To identify the authorship and its trends in documents of different subjects, since the author's influence on the publication is significant and obvious.

(viii) To ascertain the utilization of the range of languages employed in the published output on a given topic.

5.5 IMPORTANCE OF BIBLIOMETRICS / SCIENTOMETRICS:

A bibliometric environment encourages awareness of thinking, planning a sharing platform of citation and research among the teaching faculty, students, library media specialists and researchers of many field. In the creation of a bibliometric environment, faculty members (as in the present study) and researchers who cite many works, may monitor and apply their knowledge deliberately modeling bibliometric methods to assist them in becoming aware of many if not all the research work in the field of bibliometric and its related metrics family. Problem solving and research activities in all subjects provide opportunities for developing citations that help in further scientific works in the future. A researcher, say a faculty member needs to focus the attention on how tasks are accomplished. Process goals, in addition to content goals must be established and evaluated with bibliometric citation so as to discover that understanding and transferring thinking process and improving results.

In this rapidly changing world, the challenge of scientific research is to help in many aspects of life and assist in developing skills which will not become obsolete. Based on much extant research on bibliometric, a scheme for Science and Technology showing the importance of our study may also be developed. Bibliometric studies offer an interesting view of the scientific activity of any country, being basic research to obtain information for decision-making by those responsible for formulating scientific policy. The most important objectives of bibliometrics are the study of size, growth and distribution of scientific documents, and also investigation of the structure and dynamics of the concerned groups that produce and use these scientific

data and documentation. Therefore, the study of production circulation, consumption and impact of publications is the focus of bibliometrics.

Bibliometrics has come forward as an essential and well-established technique that covers a wide and huge area of knowledge, which provides for a more practical task. In the present era, Bibliometrics is attaining more sophistication and complexity having national regional and international interdisciplinary character. It has established itself as a variable and distinctive research technique of studying Science of Science based on bibliographic information. The backbone of Bibliographic technique lies in its sound theoretical foundation laid by some great pioneers, namely, (Hulme, 1923)[31], (Lotka,1926),[32] (Bradford,1934),[33] (Zipf, 1949),[34] (Pritchard, 1969)[35], (Garfield,1971),[36] (Sengupta, 1985)[37] and many others librarians or library scientists, belonging to different fields of knowledge.

The data analysis of both citations and volume of publications can be useful in planning bibliographies through statistical and tabular methods. As a matter of fact, bibliometrics provides the researchers with the needful information about the structure of knowledge, its classification studies put forward the information that related to the subject, languages, and country-wise relationship, based on literary warrant. Therefore, bibliometrics is very useful in any field of research study.

5.6 BIBLIOMETRIC INDICATORS:

Bibliometric indicators can give signals about what is going on in the research system, but results have to be interpreted to the complexity of the studied environment. Indicators compare the quantity, quality and visibility of research implemented by various individuals or institutions.

5.6.1 Sources:

The collection of necessary data (publications or patents) is the basis for the construction of bibliometric indicators. The data could be obtained by making ones own data base (by using CD-ROM, etc) or by (commercial) database such as chemical abstracts. Science Citation Index, Medline, Derwent for patents etc.

5.6.2 Publications:

Publication counts give a rough measure of the quantity of work produced by a research team or facility.

5.6.3 Citations:

Authors cite each others' papers for many reasons, but analysts generally assume that rates of citation provide some measure of the quality, relevance or interest, the impact of the cited paper. Thus, citation counts are an indicator of the influence a research has had on the larger scientific community.

5.6.4 Mapping (clustering):

Bibliometric maps provide an instrument which can be used optimally in an electronic environment. Moreover, there is a large amount of detailed information 'behind the maps'. Hence it is of crucial importance that this underlying information, particularly about research performance, can be retrieved in an efficient way, to provide the user with a possibility of exploring the fields and of judging the usefulness of maps against the user's own expertise. Advanced internet based user interface facilities are necessary to enable this further exploration of the maps and of the data 'behind the maps' (Noyons,1999)[38]. Thus bibliometric maps and their internet based user-facilities will enable

users to compare the scientific performance of groups/institutes with other 'benchmark' institutes. Likewise, the maps can be used for the selection of benchmark institutes, for instance institutes chosen by the experts.

Co-citation analysis provides an alternative type of mapping, but it unavoidably depends on the availability of citation (reference) data and thus its applicability is less general than concept similarity mapping. Co-citation maps are based on the number of times two particular articles are cited together in other articles. The development of this analytical technique is based on the pioneering work of (Small, H.,1973)[39]. When aggregated to larger sets of publications, co-citation maps indicate clusters of related scientific work (i.e. based on the same publications, as far as reflected by the cited literature). These clusters can often be identified as 'research specialties'. (McCain, 1990)[40] Their character may, however, be of a different kind compared with co-word based clusters; because they are based on citation practices they may reflect cognitive as well as social networks and relations (Braam et al, 1991)[41]. Moreover, citations only reflect a part of the intellectual structure, and they are subject to certain, often field specific, time lag.

Mapping is used to visualize the structure of research fields or specialties (sub-fields) of science, and linkages of countries in the international arena. Following are some of the methodologies, which enable mapping or clustering:

5.6.5 Co-citation analysis

Co-citation analysis monitors the number of times (two) papers are cited together in single articles or patents in a particular field of S/T. the resultant co-citation clusters reflect the subject similarity and depict the most important works in that specialty (measured by citation). This

map enables one to monitor how specialties (or sub-fields) evolve over time.

5.6.6 Co-word analysis:

Co-word analysis monitors the number of times key words are mentioned together in publication or patents in a particular field of science or technology. A map of these paring co-words describes the structure of a research field.

5.6.7 Interviews:

Interviews monitor the numbers of times key words are mentioned by Interviewed scientists during an interview on a specific subject. A map of these key words describes the structure and sub-structure of a research field.

5.7 BIBLIOMETRIC LAWS:

The bibliometric laws in this chapter are the equivalents to Newton's laws of physics. The classics of their field, built upon by others, but not perfectly correct in certain situations. Like physical laws, they seek to describe the working of a system by mathematical means. Even though bibliometric scholarship is mature, there is little evidence of any Einsteinian breakthroughs that prove bibliometric laws are concrete laws. However, they are incredibly useful in developing general theories about information and provide data to study further.

Three regularities occur in bibliometrics to which have been given the name "law": Lotka's law of Scientific Productivity (authors publishing in a certain discipline); Bradford's law of scattering (scattering of articles); Zipf's Law of Word Occurrence (ranking of word frequency). (Booksten, A.,1979)[42] claims, that the three laws are basically the same.

One of their differences lies in the type of data. Lotka's law dealt with authors publishing and the number of papers published; Bradford observed the scattering of articles on specific subjects in various journals; Zipf counted frequencies of words. (O'Conner, D; Voos, H.,1981)[43].

The three most commonly used laws which laid the foundation of bibliometrics are:

(i) Lotka's law of scientific productivity,

(ii) Bradford's law of scatter, and

(iii) Zipf's law of word occurrence,

We explain them in detail as follows:

5.7.1 LOTKA'S LAW:

Alfred J. Lotka was a mathematician, supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company from 1924 to 1933 (Word Who's Who in Science,1968)[44] . It was during this time, that his definitive work, later called Lotka's law was produced. His investigation was a productivity analysis (described in the preceding section). Counting names and the number of publications listed for each, the coverage was for only A and B names in Chemical Abstracts from 1907 to 1916 and for Auerbach's Geschichtstafeln der Physik from its beginning through 1900. The data were tabulated and plotted, from which Lotka developed a "general formula for the relation... between the frequency y of persons making x contributions" as

" X x Y = a constant."

Finding the value of the constant when n = 2, he observed that: the number of persons making 2 contributions is about one fourth of those making one; the number making 3 contributions is about one-ninth, etc; the number making n contributions is about $\frac{1}{n^2}$ of those making one, and the proportion, of all contributors, that make a single contribution, is about 60 per cent. (Lotka, A.J., 1926)[45]

Lotka's observation deals with the least number of productions.

Since the publication of Lotka's original article in 1926 much research has been done on author productivity in various subject fields. The publications arising from this research have come to be associated with Lotka's work and are often cited as proving or supporting his findings.

Lotka's law, in its generalized form, seems applicable.

(i) When we consider the publications of authors in one periodical and

(ii) When we consider all the publications of the authors in various journals, the observed values deviate considerably from the predictions of the law. This may be due to the differences between pure and applied science. (Radhakrishnan, T.; Kernizan, R.,1979)[46].

Generally, Lotka's Law is an inverse square law that for every 100 authors contributing one article, 25 will contribute 2, 11 will contribute 3, and 6 will contribute 4 each. We see a general decrease in performance among a body of authors following $\mathbf{1:n^2}$. This ratio shows that some produce much more than the average which seems agreeably true for all kinds of content creation. However, Lotka doesn't take impact into

account, only production numbers. Furthermore, in 1974, Voos found that in Information Science, the ratio was currently.

1:n. (Voos, 1974)[47]

Thus, we can say that Lotka's Law may not be constant in value, but in following inverse square. Our challenge will then be to find the correct exponent in different mediums and fields.

Table: 5.1 RANKING OF AUTHORS

No. of authors	No. of articles
100	1
25	2
11	3
6	4
4	5

5.7.2 BRADFORD'S LAW OF SCATTERING:

Samuel Clement Bradford was a very determined and dedicated person. His thinking was undoubtedly influenced by Paul Otlet and Henri LaFontaine, who organized the First International conference on bibliography held in Brussels in 1895. The theme of the conference was the need for international cooperation to develop a universal index which would recognize the requirement of a standard subject classification to be backed by a central universal library. This idea was staunchly supported by Bradford, as shown in the following paragraphs.

In 1927 "Bibliography by cooperation" appeared in Library Association Record (LAR) wherein Bradford indicated his concern for the accelerated accumulation of "useful scientific and technical literature". He included in his paper a list of science subjects and the number of bibliographic references for each to alert readers as to what the science Library, of which he was deputy keeper, was doing to develop into an "information service covering the whole field of Science and Technology. At that time, Bradford claimed the number of references assembled, covering many aspects of Science and Technology, as 1, 212, 00. (Bradford, S.C.,1927)[48].

This article was followed by his another article titled "The necessity for the Standardization of bibliographical Methods" in which Bradford explained the Science Library's method of classification and again stressed the need for cooperation. By the time of the introduction of the paper, a form of interlibrary loan had already been practiced for 2 years by the Science Library, with requests having been received from a number of other countries. (Bradford, S.C.,1928)[49].

One of Bradford's hypotheses was that "references are scattered throughout all periodicals with a frequency approximately related inversely to the scope. On this hypothesis, the aggregate of periodicals can be divided into classes according to relevance of scope to the subject concerned, but the more remote classes will, in the aggregate, produce as many references as the more related classes.

Observations of the tables evinced three "rough" zones or groupings which Bradford's graded as "1) Those producing more than 4 references a year. 2) Those producing more than 1 and not more than 4 a year. 3) Those producing 1 or less a year. Bradford found that "The groups thus produce about the same proportion of references in each

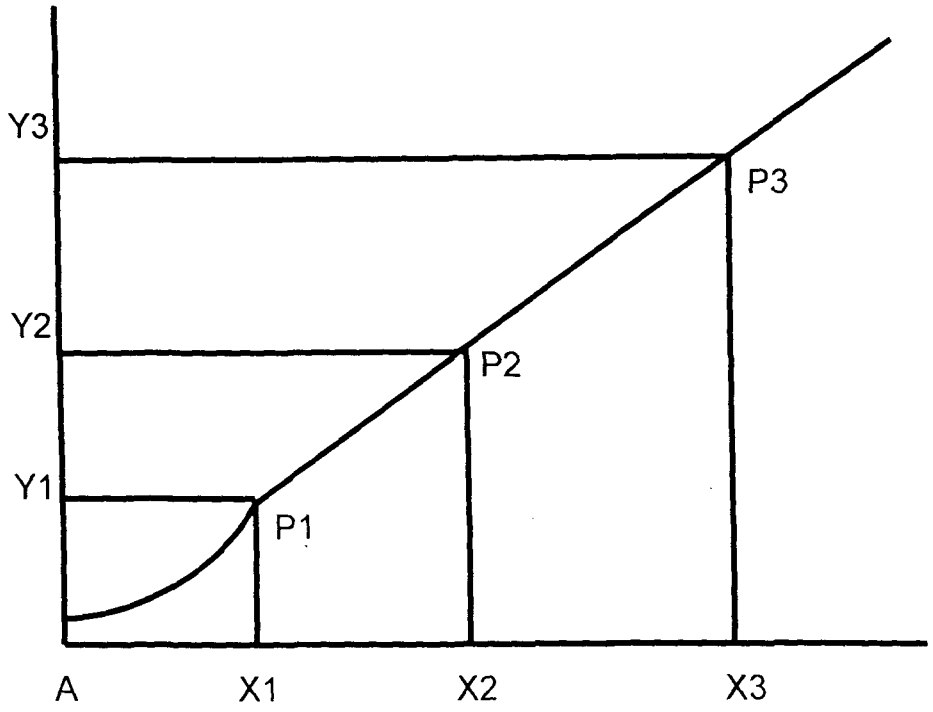
case, and the number of constituents increases from group to group, by a multiplier which though by no means constant, approximates fairly closely to the number 3, especially for the two larger groups.

From his data, Bradford constructed two graphs, plotting the logarithms of cumulated number of journals in relation to the cumulated number of references for each, geophysics and lubrication. He noted that "the later portion of each curve is remarkably close to a straight line," and observed that "the aggregate of references in a given subject, apart from those produced by the first group of large producers, is proportional to the logarithm of number of sources concerned, when these are arranged in order of productivity. with this observation in mind, Bradford constructed a second graph or diagram. This diagram he used to develop an algebraic relation, but only for the "straight" part of the curve noted originally, from this he deduced his "law".

The law of distribution of papers on a given subject in scientific periodicals may thus be stated;

If scientific journals are arranged in order of decreasing productivity of articles on a given subject they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as :-

1: n: n2 (Bradford, S.C.,1934)[50]



S.C. Bradford also plotted graph of the cumulative number of source items R(n) verses the logarithm values of the cumulative number of journals (log n) such a graph, is sometimes called as Bradford's Bibliograph.

The graph being as a rising curves API, and then continues as a straight line. The rising part of the graph represents the nucleus of highly productive journals. The points P1, P2 and P3 on the bibliographs are the boundaries of three equi-productive zones in which the same number of years.

This was the first statement of what was later to be called the verbal part of Bradford, Law, Usually referred to a as Bradford's law of distribution of Scattering, "sometimes this regularity is also called the law of dispersal of publications" (Yablonsky, A.I.,1980)[51].

Contribution of B.C. Vickery and B.C. Brookes

Bradford's work was extended by many, notably Vickery and Brookes. It was (Vickery, B.C., 1948)[52] who realized that Bradford in fact formulated two laws, in that his verbal description is dissimilar from his graphical interpretation. The former describes his theory while the other traces his observations. Brookes' work (Brookes, B.C. 1969)[53] has been on the graphical version of the distribution; and the work produced by this method appears to fit empirical data more accurately than the mathematical versions of Bradford's verbal theory.

The production of a bibliography involves the use of semi-logarithmic scales, which turn the hyperbolic curves of linear scales into straight lines.

Journals are ranked in decreasing order of the number of relevant papers. The cumulative number of papers is then derived. The rank of journal is plotted on the horizontal semi-log axis, and the cumulative number of papers is plotted on the vertical linear axis.

Once the bibliograph has started to form a straight line it can be continued by rule, and an estimate made of the end point.

The plot will have two distinct sections, the rising curve and then the linear section. The demarcation of the core is which is the section prior to the linearity, and the intercept of the linear section with the horizontal axis.

5.7. 3 ZIPF'S LAW OF WORD OCCURRENCE

George Kingsley Zipf (1902-1950) was a Professor of Linguistic at Harvard. He developed and extended an empirical law, which was named as "Zipf's Law of Word Occurrence". This law is of the

observation that frequency of words within a text or occurrence of some event (P), as a function of the rank (i) when the rank is determined by the above frequency of occurrence, is a power-law function Pi ~$1/i^a$ with the exponent a close to unity.

The most famous example of Zipf's law is the frequency of English words. The second example Zipf showed in his book was the population of cities (or population of communities). The population of the city as plotted as a function of the rank (the most popular city is ranked number one, etc) is a power-law function with exponent close to '1'. The income or revenue of a company as a function of the rank is also an example of the Zipf's law (also in Zipf's book). This should also be called the Pareto's law because Pareto observed this at the end of the last century. As it has been observed, governing a relation between the rank of a word and the frequency of its appearance in a long text if 'r' is the rank of a word and 'T' is its frequency, then mathematically Zipf's law can be stated as follows:

$rf = c,$ Where 'c' is a constant,

More precisely the Law states that in a relatively lengthy text, if you "list the words occurring within that text in order of decreasing frequency, the rank of a word on that list multiplied by its frequency will equal a constant".

The equation for this relationship is:

$r \times f = k$ (where r is the rank of the word, f is the frequency, and k is the constant)" (Potter, 1988)[54].

Zipf illustrated his law with an analysis of James Joyce's Ulysses. "He showed that the tenth most frequent word occurred 2,653 times, the

hundredth most frequent word occurred 265 times, the two hundredth word occurred 133 times, and so on. Zipf found, then that the rank of the word multiplied by the frequency of the word equals a constant that is approximately 26,500".

The following table shows distribution of words inversely proportional to the frequency of occurrence of the word:

Table: 5.2 RANKING OF WORD OCCURRENCE

Rank (r)	Frequency (f)	Product (c)
1	400	400
2	200	400
3	133	399
4	100	400
5	80	400

Zipf's Law, again, is not statistically perfect, but it is very useful for indexers. His law states that in a long textual matter if words are arranged in their decreasing order of frequency, then the rank of any given word^' of the text will be inversely proportional to the frequency of occurrence of the word.

Thus, these three laws are respectively based on

(i) Number of authors contributing in a discipline or other field;

(ii) Distribution of articles in a set of journals; and

(iii) Ranking word frequency in a particular set of documents. Other, albeit more specific, laws can be used for specific purposes. When applying these laws to bibliometrics and scientometrics analysis, implementation details can be easily imagined.

There are many other laws of bibliometrics and its related family, which have been put forward by many researchers and librarians the world over. It will therefore, be worthwhile to highlight some of them as an accepted matter of fact, as follows:

Square Root Law of Price States: "Half of the scientific papers are contributed by the square root of the total number of scientific authors" (Price, (Derek J de Solla, 1971,)[55].

Garfield in his Law of Concentration argues: "A basic concentration of journals is the common core or nucleus of all fields." (Garfield, Eugene, 1971)[56].

Sengupta In his new bibliometric law, comments: "During phases of rapid and vigorous growth of knowledge in a scientific discipline, articles of interest to that discipline appear in increasing number in periodicals distant from that field.", mathematically this law stands in the following form:

$$F(x + y) = a + b \log (x + y)$$

Where, f(x + y) stands for the cumulative number of the references in the first (x + y) most productive journals, 'x' indicates number of journals in the same discipline and 'y' stands for the journals of related discipline, while, (y > x), and 'a' 'b' are parameters which stand for constants.

Bibliometrics offers the library and information field much and a lot to come. The research work by Lotka, Bradford and Zipf, indeed, is valuable in helping librarians and researchers who assess patterns of authorship, Identify core collections and design better retrieval systems (Sengupta, I.N., 1973)[57].

5.8 APPLICATIONS OF BIBLIOMETRIC LAWS

One of the main areas in bibliometric research concerns the application of bibliometric laws. The exponential growth of literature and rapid development of libraries generated several evolutionary studies about the effectiveness and efficiency of information services. These studies led to the identification and application of appropriate quantitative measuring techniques known as bibliometrics. Libraries and information managers all over the world began to use bibliometrics techniques in their day to day administration. These bibliometrics studies throw light on the pattern of growth of literature, inter-relationship among different branches of knowledge, productivity and influence of authors, pattern of collection build up, their use and so on. Day by day bibliometrics is attaining inter disciplinary character and sophistication.

Another useful idea is, suppose there is an endemic outbreaks occurring from time to time. Research and reference can follow cycles of use, this is very similar to ideas like memes and paradigm shifts. All of the above bibliometric techniques can be used to test for this theory. Software can be used to study document representations, references, and citations. We can then compare a matrix of values to find correlations. We can also use a technique like this to help design future documents by using like terms, references, and citations to establish stronger linkage relationships among documents.

(i) To quantify research and growth of different area of knowledge:

(ii) To estimate comprehensiveness of secondary periodicals.

(iii) To identify users and authorship of documents of various subjects;

(iv) To measure usefulness of ad hoc and retrospective SDI services:

(v) Experimental models correlating or bypassing the existing models;

(vi) Identification of core journals in different disciplines to formulate a need based acquisition policy within the limited budgetary provision without detriment to the research interest of the parent organization;

(vii) To initiate effective multilevel network system;

(viii) To regulate inflow of information and the communication ; and also

(ix) To develop norms of standardization; and so on.

5.9 LIMITATIONS IN APPLICATION OF THE LAWS

The studies of bibliometrics' family left no doubt of their usefulness in achieving wonderful results, here, bibliometric studies are very helpful to library and information science research users, but there are many short-comings. These limitations are also in their application. Here, we highlight some of them. Bibliometrics, scientometrics data are likely to under represent the level of international collaborative research, a further limitations exists in determining just how much work an individual author contribute to a coauthored publication, Wilson and Osareh, (2003) [58]. It has been argued by O'connor and Voos (1981)[59] that bibliometrics: "is merely a method or if it meets the test of a theory

in its ability to explain and predict phenomena. This paper examines the properties of bibliometric distributions in a non-technical manner", and they have mentioned that bibliometrics has largely been used to describe bibliography and is not yet able to explain and predict them, then, it is merely a method and not a theory.

5.10 CONCLUDING REMARKS

This chapter has examined the potential benefits of applying bibliometrics to finding out more about scientometrics usage. As we gain wisdom about behavior of these laws, in chapter six, we are going to apply these laws in science and information technology at the faculty teaching level of the Jordanian Universities. (O'connor and Voos,1981)[60] have mentioned that bibliometrics has offered us by: "the promise of providing a theory that will resolve many practical problems. It is claimed that patterns of author productivity, literature growth rates and related statistical distributions can be used to evaluate authors, assess disciplines and manage collections". Therefore, information discovered through the application of bibliometrics laws and techniques has the potential of saving, time money and other things, provide more appropriate programmes, and meet more of the users and researchers needful information resources collections.

Bibliometric and scientometrics along with the related other terms can provide data to justify the difficult decisions and funding requests by library administrators, and also this family of metrics can inform the processes and products of knowledge management that have grown in importance within contemporary organization and educational institutions.

Scientometrics/bibliometrics terms are the analysis of the structure of literature using various tools, counting, rank-frequency

distributions, and vitiations analysis, although the structure of literature is basic to all disciplines. The studies of metrics family, specifically bibliometrics and scientometrics have left no doubt of their usefulness in achieving wonderful results. Here we believe that bibliometrics studies are very helpful to library and information science research users, but there are many limitations in the applications of their laws.

Though most of the research studies sided with the utilization of Bradford scattering distribution, some others researchers could not find satisfactory outputs. Some researcher found that Lotka's law is perfect in most of the cases of especially to sciences however, the value of the index 'n' was found to vary for different groups of scientists; these limitations have left many researchers questioning these laws, (Vijaykumar, 1997)[61].

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Chapter Six

Data Collection and Analysis

CHAPTER SIX

DATA COLLECTION AND ANALYSIS

To conduct research on the topic "Publications in Science and Technology by Faculty Members in Universities of Jordan: A Scientometric Study" the data had been from collected from comprehensive and appropriate sources of literature in the field of Science and Technology. They are:-

- Abstract of Funded research projects at the University of Jordan
- Yarmouk University research publications
- Jordan University research publications (Database)
- Database of Arab periodicals "Yarmouk University"
- Funded Research Projects (Jordan University of Sciences and Technology)
- Index Mu'tah studies and research
- Index Dirasat
- Index Abhath al-Yarmouk
- Jordan National Bibliography

A database was developed using Oracle8i package as discussed in chapter 1.

Next step is to tabulate and analyze the data collected from various sources in order to conduct the following studies-

6.1 Ranking of Periodicals

Periodicals are one of the most important sources of current information. They are classified under primary sources. As it happens, the new knowledge that are generally the findings of original research work, are first reported in the primary documents.

The periodicals have therefore assumed the most important place in the sources of information. They mostly carry within them contain original contributions and are categorized into, technical journals, trade journals, popular journals, house journals etc. The information contents provided by them are varied and serve different purposes. Periodicals generally possess the following characteristics:-

1. They are published under a regular title and appear at regular intervals, based on which they are designated as weeklies, monthlies, quarterlies, biannual or annuals
2. Each issue of the periodical contains more than one article.
3. The article appearing in one issue of the journal may devote to the various aspects of the subject within the scope of the journal.
4. It is also not uncommon to find all the contributions in a particular issue of the journal on a particular theme.

As per the definition given in the general conference of UNESCO, held at Paris on 19 Nov. 1964, 'periodical is one that constitutes one issue in a continuous series under the same title, published at regular or irregular intervals, over an indefinite period, individual issues in the series being numbered consecutively or each issue being dated' (Prylherch, 2005)[1].

The periodicals or the journals have been the major dissemination medium in the field of Science and Technology since the 17th century. However, the information explosion which started in the post world war era has earned a great deal of criticism regarding the role played by the journals in scientific community. The major problem area had been the delay between submission of articles and its publication in scientific journal that takes an average of 7 to 15 months. The advent of Information Technology and resulting change in the format from hard copy to electronic journal has reduced this gap between submission of

the articles and its publication, but there is enough time lag still. This is probably due to the fact that the tremendous growth in scientific research is putting more pressure on peer reviewed journals. The only redeeming factor is time saving in the transportation of the journal in electronic environment. Also the utility of the electronic format is that the researchers are interested in only a small proportion of papers in any issue which they may get as and when they want.

The periodicals contributing most of the literature of research value in a given field are called 'core journals'.

The main aim of the present study is to identify the most important journals or the core journals wherein most of the articles have been contributed by the faculty members of Jordanian Universities in the field of Science and Technology. This information will be useful from the point of view of faculty members themselves as also for the librarians in planning library services. The researchers would come to know through this study about the various core journals that are preferred by the faculty members of Jordanian Universities in Science and Technology. The librarians may utilize this information while preparing the subscription list of periodicals, whether in hard copy or Electronic form.

The collected data includes 5880 references published in 524 journals that have been ranked up to 28^{th} position.

Table 6.1(A) enumerates all the 524 journals along with their frequency of occurrence in the order of decreasing productivity. An analysis of the table shows that most of the faculty members have preferred to get their scientific contributions published in the periodicals issued from Jordan itself. That's why the top seven journals in the table are published from Jordan. All these journals belong to important discipline of Science and Technology like Agriculture, Engineering, Medicine, Biology, Pure Science etc. Of the top seven journals most of

the contributions have been made in 'Dirasat' that is published from 'University of Jordan'

In fact, this is the journal that publishes itself into five main branches of Science and Technology and is therefore, titled as

(1) Dirasat, Agriculture Science

(2) Dirasat, Engineering Science

(3) Dirasat, Medical and biological Science

(4) Dirasat, Pure Science

(5) Dirasat, Pure Science and Engineering

The reason of publication of the articles in 'Dirasat' is because of its coverage in Arabic as well as in English. Another important feature of Dirasat is the abstracts of the articles that are published both in Arabic as well as in English, irrespective of the fact whether the article itself is in English or in Arabic.

Same is the case with 'Mu'tah journal for Research and Studies' published from Mu'tah University and 'Abhath AL-Yarmouk' published from 'AL-Yarmouk University'. It is therefore evident that the faculty members of Jordanian Universities find it convenient to get their scientific contributions published in the top seven journals from Jordan, of which the first place is occupied by 'Dirasat, Pure Sciences', that includes as many as 406 references constituting 7% of the total. 'Mu'tah journal of research and Studies' occupies the second rank and has published 6.7% of the total literature under purview. The third place is occupied by "Abhath' Al Yarmouk' journal publishing 6.3% of the total published output covered during the period of study.

It may be noted that 'Dirasat, Pure Sciences' covers literature on Pure Sciences only including subjects like Biology, Physics, Chemistry, Earth Science and Mathematics.

This is followed by 'Mu'tah journal for Research and Studies' and 'Abhath AL-Yarmouk' devoted to the field of Science and Technology.

Of the other specialized fields, Agriculture occupies the largest chunk of 4.6% contributions reported in 'Dirasat, Agriculture Science'. This is followed by 'Engineering Science' constituting 3.6%; 'Dirasat, Medical and Biological Sciences' constituting 3.4% and 'Dirasat, Pure Science and Engineering' constituting 3.2% of the total contributions.

The faculty members of Jordanian universities also like to publish in foreign journals mainly from USA, Germany and Australia. This is evident from the fact that the 8th rank is occupied by two journals namely "IEEE Journal Proceedings and Transactions" published from USA, and 'Environmental Geology' published from Germany and 'Electrical world' published from Australia occupies 9th position.

Table 6.1(A) Ranking of Periodicals

S. No.	Rank	Name of Periodicals	Place	Freq.	%age
1.	1	Dirasat, Pure Sciences	Jordan	406	7.0
2.	2	Mu'tah, Journal for Research and studies	Jordan	391	6.7
3.	3	Abhath Al-Yarmouk	Jordan	371	6.3
4.	4	Dirasat, Agricultural Science	Jordan	266	4.6
5.	5	Dirasat, Engineering Science	Jordan	210	3.6
6.	6	Dirasat, Medical and Biological Sciences	Jordan	197	3.4
7.	7	Dirasat ,Pure Science and Engineering	Jordan	186	3.2
8.	8	IEEE Journal Proceedings and Transactions	USA	33	0.56
9.	8	Jordan Medical Journal	Jordan	33	0.56
10.	8	Environmental Geology: International journal of geosciences	Germany	33	0.56

11.	9	Electrical world	Australia	30	0.51
12.	9	Jordan Engineering	Jordan	30	0.51
13.	9	Arab Gulf Journal for Scientific Research	Saudi Arabia	30	0.51
14.	9	Journal of Applied Physics	USA	30	0.51
15.	9	Journal of King Abdulaziz University	Saudi Arabia	30	0.51
16.	9	Saudi Medical Journal	Saudi Arabia	30	0.51
17.	9	Basic Science Symposium Series	USA	30	0.51
18.	9	Radiation Measurements	UK	30	0.51
19.	9	Asian Journal of Chemistry	India	30	0.51
20.	10	Acta Technologiae et Legis Medicamenti	Italy	29	0.50
21.	10	Journal of Arid Environment	UK	29	0.50
22.	10	Bulletin of Faculty of Engineering	USA	29	0.50
23.	11	International Symposium on Advanced Research in asynchronous circuits and systems	USA	27	0.46
24.	11	Physics and Biology	USA	27	0.46
25.	11	Computer Standards and Interfaces :the international journal devoted to computer standards, their implementation and utilization	USA	27	0.46
26.	11	Indian Journal of Chemistry	India	27	0.46
27.	11	International Journal of Circuit Theory and Application	UK	27	0.46
28.	11	Journal of Mathematical Science	USA	27	0.46
29.	11	Die Pharmazie:an international	Germany	27	0.46

		pharmaceutical Sciences			
30.	11	Computer Industry Digest	USA	27	0.46
31.	11	Algebras Groups Geometries	USA	27	0.46
32.	12	Allelopathy Journal	India	24	0.40
33.	12	Faster Wheeler Review	USA	24	0.40
34.	12	Indian Journal of Plant Physiology	India	24	0.40
35.	12	Heat and Mass Transfer Journal	USA	24	0.40
36.	12	Journal of Computational Chemistry	USA	24	0.40
37.	13	Journal of Inclusion phenomena and macro cyclic chemistry	Netherlands	20	0.34
38.	13	Journal of Information and Optimization Sciences	India	20	0.34
39.	13	Journal of Material Science	USA	20	0.34
40.	13	Physica Scripta :an monthly international journal for experintental and the oretical physics	Sweden	20	0.34
41.	13	Agricultural Water Management	Belgium	20	0.34
42.	13	Applied and Environmental Microbiology	USA	20	0.34
43.	13	Energy Journal	Netherlands	20	0.34
44.	13	Hydrogeology Journal	Germany	20	0.34
45.	13	Industrial Engineer: Engineering & management solution of work	USA	20	0.34
46.	13	International Journal for Heat and Technology	USA	20	0.34
47.	14	International Journal of Mathematics and Mathematical Sciences	USA	18	0.30

48.	**14**	Journal of Ethnophamacology	Ireland	18	0.30
49.	**14**	Journal of Mathematics and Computer Science	USA	18	0.30
50.	**14**	Magneto Hydro Dynamic	USA	18	0.30
51.	**14**	Electric power components and Systems	USA	18	0.30
52.	**14**	Journal of Mathematics Analysis Applied	USA	18	0.30
53.	**14**	Digital signal processing :a review journal	USA	18	0.30
54.	**14**	Journal Animal and Feed Sciences	Poland	18	0.30
55.	**15**	Asian Journal Aesthetic Dent.	Singapore	17	0.28
56.	**15**	Bulletin of Environmental Contamination and Toxicology	USA	17	0.28
57.	**15**	Egyptian Dental Journal	Egypt	17	0.28
58.	**15**	Journal of Electromagnetic Waves and Application	Netherlands	17	0.28
59.	**15**	Journal of Fractional Calculus	Bulgaria	17	0.28
60.	**15**	Journal of Heterocyclic Chemistry	USA	17	0.28
61.	**15**	Microbiology	UK	17	0.28
62.	**15**	MicroElectronics and Reliability:an international journal and world abstracting service	UK	17	0.28
63.	**15**	Pakistan Journal of Statistics	Pakistan	17	0.28
64.	**15**	Surgery Today	UK	17	0.28
65.	**15**	Synthesis :journal of synthetic organic chemistry	Japan	17	0.28
66.	**15**	Water Research	Germany	17	0.28
67.	**15**	Drug and chemical Toxicology :an international journal for rapid communication	USA	17	0.28

68.	**15**	Applied Mathematics and Computer	USA	17	0.28
69.	**15**	Acta Mathematica Hungarical Journal	Hungary	17	0.28
70.	**15**	Agronomy Journal	USA	17	0.28
71.	**15**	Alexandria Journal of pharmaceutical Sciences	Egypt	17	0.28
72.	**15**	Chemical papers	Slovakia	17	0.28
73.	**15**	Computers and Mathematics with Applications	UK	17	0.28
74.	**15**	European Journal of pharmacology	Netherlands	17	0.28
75.	**15**	Far East. Journal Applied Math	India	17	0.28
76.	**15**	Food Chemistry	Netherlands	17	0.28
77.	**16**	International Journal of Electronics	UK	16	0.27
78.	**16**	International Journal of Project Management	UK	16	0.27
79.	**16**	The International Quarterly of community Health Education	USA	16	0.27
80.	**16**	Journal of Material Chemistry	UK	16	0.27
81.	**16**	Journal of Lightwave Technology	USA	16	0.27
82.	**16**	Journal of Mathematical Analysis & Application	USA	16	0.27
83.	**16**	Journal of Tropical Pediatrics	UK	16	0.27
84.	**16**	Journal of Applied Statistical Sciences	USA	16	0.27
85.	**16**	Journal of Engineering and Technology Management	Netherlands	16	0.27
86.	**16**	Journal of Insect Science	India	16	0.27
87.	**16**	Mathematics Student	India	16	0.27

88.	17	Mathematics magazine	USA	14	0.24
89.	17	Tanta University Journal	Egypt	14	0.24
90.	17	Turkey Journal of Mathematics	Turkey	14	0.24
91.	17	Acta mathemtica	Sweden	14	0.24
92.	17	Geologic Africaine	France	14	0.24
93.	17	Alexandria dental Journal	Egypt	14	0.24
94.	17	Applied Science	USA	14	0.24
95.	17	Applied Clay. Science :an international journal on application and technology of clays and clay minerals	Netherlands	14	0.24
96.	17	Applied Environmental Education and Communication	USA	14	0.24
97.	17	Chemische Berichte :European journal of inorganic chmistry	Germany	14	0.24
98.	17	Clinical Hemortheology and Microcirculation	Netherlands	14	0.24
99.	17	Community dental Health	UK	14	0.24
100.	17	Contraception	USA	14	0.24
101.	17	Damascus University Journal for Health Science	Syria	14	0.24
102.	17	Geophysics Journal	Switzerland	14	0.24
103.	17	Journal Manufacturing Technology Management	UK	14	0.24
104.	17	InfoWorld : defining technology for businees	USA	14	0.24
105.	17	Journal Geometry	Switzerland	14	0.24
106.	18	Fraction calculus and Applied Analysis	Bulgaria	13	0.22
107.	18	Institute for Computer Based Learning	UK	13	0.22

108.	18	Linear algebra and its Applications	USA	13	0.22
109.	18	Mathematical Al gorithms	USA	13	0.22
110.	18	Medical Journal of Islamic Academy of Science	Turkey	13	0.22
111.	18	Mutation Research :international journal on mutagenesis	Netherlands	13	0.22
112.	18	National Academy of Medical Science	India	13	0.22
113.	18	Photochemistry	USA	13	0.22
114.	18	Recent Advances in Clinical Biochemistry	UK	13	0.22
115.	18	Southern Weed Science Society Proceeding	USA	13	0.22
116.	18	Signal processing :an international journal devoted to methods and applications of signal processing	Netherlands	13	0.22
117.	18	Journal Parapsychology	USA	13	0.22
118.	18	Agricultural Systems	Netherlands	13	0.22
119.	18	Analytical Sciences	Japan	13	0.22
120.	18	Journal of crop Improvement : innovations in practice, theory & research	USA	13	0.22
121.	18	Bilateral Seminars of the International Bureau	Germany	13	0.22
122.	18	Biochemistry	USA	13	0.22
123.	18	Journal of Mathematical Methods in Biosciences	Germany	13	0.22
124.	18	Bio-resources Technology	Netherlands	13	0.22
125.	19	CAB International Data Base	UK	11	0.19

126.	19	Chemistry	Germany	11	0.19
127.	19	Eastern Mediterranea Health Journal	Egypt	11	0.19
128.	19	Education Practice	France	11	0.19
129.	19	Energy Conversion and Management	UK	11	0.19
130.	19	Ferrara-Bologna	Italy	11	0.19
131.	19	Freiberger Forschungshefte, Reihe C-Palaeontologie, Stratigraphie, Fazies	Germany	11	0.19
132.	19	Fuzzy systems and mathematics	China	11	0.19
133.	19	Geometrical Journal	Turkey	11	0.19
134.	19	Hokkaido Mathematical Journal	Japan	11	0.19
135.	19	International Journal of Engineering Simulation	UK	11	0.19
136.	19	International Journal of Pharmaceutics	Netherlands	11	0.19
137.	20	Journal of Oral Rehabilitation Clinical Science and Materials	UK	10	0.17
138.	20	Russian Journal of Organ Chemistry	Russian	10	0.17
139.	20	Applied Biochemistry and Biotrnology	USA	10	0.17
140.	20	Journal of Solid Waste Technology and Management	USA	10	0.17
141.	20	Journal African Science & Technology	Kenya	10	0.17
142.	20	Journal of Advanced Nursing	UK	10	0.17
143.	20	Journal of Algebra	USA	10	0.17
144.	20	Journal of Applied Botany	Germany	10	0.17
145.	20	Journal of Coordination	UK	10	0.17

		Chemistry			
146.	**20**	Journal of Science	Iran	10	0.17
147.	**20**	Numerical Function Analysis & Optimization	USA	10	0.17
148.	**20**	Pan American Mathematical Journal	USA	10	0.17
149.	**20**	Physics Today	USA	10	0.17
150.	**20**	Polyhedron :international journal for inorganic and organ metallic chemistry	UK	10	0.17
151.	**20**	Pure and applied Geophysics	Switzerland	10	0.17
152.	**20**	Qatar University Science Journal	Qatar	10	0.17
153.	**20**	Radiation protection Dosimetry	UK	10	0.17
154.	**20**	Revista Columbiana De. Mathematics	Colombia	10	0.17
155.	**20**	Russian Academy of Science	Russian	10	0.17
156.	**20**	Statistics and Computing	USA	10	0.17
157.	**20**	Technical Physical Letters	Russian	10	0.17
158.	**20**	Tetrahedron :international journal for rapid publication of critical	UK	10	0.17
159.	**20**	Third International Conference on Chemistry Industry	USA	10	0.17
160.	**20**	Toxicology mechanisms and Methods	USA	10	0.17
161.	**20**	Applied Catalysis :an international journal devoted to catalytic science	Netherlands	10	0.17
162.	**20**	International Journal of Chemistry	USA	10	0.17
163.	**20**	International Journal of Communication Systems	UK	10	0.17

164.	**20**	Organ and Bimolecular. Chemistry	UK	10	0.17
165.	**20**	Trends in Parasitolgy	UK	10	0.17
166.	**20**	Parasitology Research	Germany	10	0.17
167.	**20**	International Conference on Electronics, Circuits and Systems	USA	10	0.17
168.	**20**	Arthritis and Rheumatism	USA	10	0.17
169.	**21**	Academic Open Internet Journal	Bulgaria	8	0.14
170.	**21**	Acta Biology Hungarica	Hungary	8	0.14
171.	**21**	Acta Cytologyica : the journal of clinical cylopathology	USA	8	0.14
172.	**21**	Acta Crystatallographica	Denmark	8	0.14
173.	**21**	Acta Physica slovaca	Slovakia	8	0.14
174.	**21**	Aden Journal of Natural and applied Sciences	Yemen	8	0.14
175.	**21**	African plant protection	South Africa	8	0.14
176.	**21**	American Journal Tropical Med. Hyg	USA	8	0.14
177.	**21**	American Mathematics Monthly	USA	8	0.14
178.	**21**	Annals of Neurology	USA	8	0.14
179.	**21**	Annals of Tropical pediatrics. International Child Health	UK	8	0.14
180.	**21**	Antisense Research and Development	USA	8	0.14
181.	**21**	Applied Mathematics Letters : an international journal of rapid publication	USA	8	0.14
182.	**21**	Applied Geochemistry : journal of international association of geochemisteryaul cosmohemistry	UK	8	0.14

183.	21	Applied Optics	USA	8	0.14
184.	21	Applied and Environmental Micrology	USA	8	0.14
185.	21	Archives of Environmental contamination and Toxicology	USA	8	0.14
186.	21	Asian Journal of Surgery	Hong Kong	8	0.14
187.	21	Asian Journal of Pure Science	India	8	0.14
188.	22	Australian & New Sealand Journal Statistics	Australia	7	0.12
189.	22	Bell & Howell Information & Learning,	USA	7	0.12
190.	22	Bulletin of the Malaysian Mathematical Society	Malaysia	7	0.12
191.	22	Caro Dental Journal	Egypt	7	0.12
192.	23	Chemie Der Erde : journal of chemical problems of the geosciences and genecology	Germany	6	0.10
193.	23	Clay Research	India	6	0.10
194.	23	Clinical Implant Dentistry and Related Research	Germany	6	0.10
195.	23	Contemporary Mathematics	USA	6	0.10
196.	23	Egypt. Journal of Microbiology	Egypt	6	0.10
197.	23	Emirates Journal of Agricultural Science	Emirate Arab United	6	0.10
198.	23	Environmental Bulletin	Belgium	6	0.10
199.	23	General relativity and Gratification	USA	6	0.10
200.	23	Geochemical Journal	Japan	6	0.10
201.	23	Journal of Ground water	USA	6	0.10
202.	23	Herpetology Research	Ireland	6	0.10

203.	23	Heteocycles	Japan	6	0.10
204.	23	Immunology and medicine Microbiology	Netherlands	6	0.10
205.	23	International Journal of Pediatrics' Dental	UK	6	0.10
206.	23	International Immunology	UK	6	0.10
207.	23	International Journal of Mathematical Education Science Technology	UK	6	0.10
208.	23	International Journal of Nursing practice	Australia	6	0.10
209.	23	International Arab on Information Technology	Jordan	6	0.10
210.	23	International Journal for Numerical Methods in Engineering	UK	6	0.10
211.	23	International Journal of Clinical Pharmacology and therapeutics	Germany	6	0.10
212.	23	Iraqi Journal of Science	Iraq	6	0.10
213.	23	Iraqi Dental Journal	Iraq	6	0.10
214.	23	Journal of Dispensary Science Technology	USA	6	0.10
215.	23	Journal of Electrical Materials	USA	6	0.10
216.	23	Journal of Saudi Chemistry Society	Saudi Arabia	6	0.10
217.	23	Journal of Injection Molding	USA	6	0.10
218.	23	Journal of Geology Chemical	USA	6	0.10
219.	23	Journal of Physics Chemistry	USA	6	0.10
220.	23	Journal of Non-Crystalline Solids	Netherlands	6	0.10
221.	23	Journal of Cereal Science	UK	6	0.10
222.	23	Journal of Chemical Technology and Biotechnology	UK	6	0.10

223.	23	Journal of European Ceramic Society	UK	6	0.10
224.	23	Journal of Petroleum Science and Engineering	Netherlands	6	0.10
225.	23	Journal of Surveying Engineering	UK	6	0.10
226.	23	Journal of Technology	India	6	0.10
227.	23	Microbiology Today	UK	6	0.10
228.	23	Medical Engineering and Physics	UK	6	0.10
229.	23	Medicine Science and Law	UK	6	0.10
230.	23	Menemui malematik	Malaysia	6	0.10
231.	23	Neuroanatomy	Turkey	6	0.10
232.	23	New microbiological	Italy	6	0.10
233.	23	Palaeogeography, palaeclimatology :an international for the geosciences	Netherlands	6	0.10
234.	23	Pergamon :Biological science series	UK	6	0.10
235.	23	Physics Statistics Sol.	UK	6	0.10
236.	24	Quarterly Journal of International Agriculture	Germany	5	0.08
237.	24	Pharma Technologic Journal	Germany	5	0.08
238.	24	Science Probe	USA	5	0.08
239.	24	Solar Energy : international journal for scientists	UK	5	0.08
240.	24	Studia Logica :an international journal for symboliclogic	Netherlands	5	0.08
241.	24	Tetrahedron Review :a data base magazine for data warehouse professionals	USA	5	0.08
242.	24	The Engineer	UK	5	0.08
243.	24	The Trend in Engineering	USA	5	0.08

244.	24	Tropical Medicine	Japan	5	0.08
245.	24	World science Report	France	5	0.08
246.	24	World Journal of Microbiology and biotechnology	Netherlands	5	0.08
247.	24	Ziva	Czech	5	0.08
248.	24	Al-Azhar bulletin of Science	Egypt	5	0.08
249.	24	Clays and clay minerals	USA	5	0.08
250.	24	Diagnostic microbiology and Infections Diseases	USA	5	0.08
251.	24	Electronic Letter	Canada	5	0.08
252.	24	Hyperfine Interactions	Netherlands	5	0.08
253.	24	International Journal Mathematics & Mathematical Science	USA	5	0.08
254.	24	International Journal of e-learning	USA	5	0.08
255.	24	International Journal of Pure & Mathematics	Bulgaria	5	0.08
256.	24	Physical Review	USA	5	0.08
257.	24	Topology :an international journal mathematics	UK	5	0.08
258.	24	Semiconductor Electronic Journal	Thailand	5	0.08
259.	24	Solid State Communications	UK	5	0.08
260.	24	Al-Basra Cervical	Iraq	5	0.08
261.	24	Accelerator	Canada	5	0.08
262.	24	Acta Microbiologica et Immunologica	Hungary	5	0.08
263.	24	Acta Pharmaceutica Turcica	Turkey	5	0.08
264.	25	Actinomycetes	Italy	4	0.07

265.	25	Agebra Universalis	Switzerland	4	0.07
266.	25	Al-Bahrain Journal	Bahrain	4	0.07
267.	25	Alpha :Mathematikals Hobby	Germany	4	0.07
268.	25	American Geophysical Union	USA	4	0.07
269.	25	American Institute of Physics	USA	4	0.07
270.	25	American Control Conference	USA	4	0.07
271.	25	An International Journal (BIJ)	USA	4	0.07
272.	25	Annals of Agricultural Science	Egypt	4	0.07
273.	25	Annals of Neurology	USA	4	0.07
274.	25	Annals of Saudi Medicine	Saudi Arabia	4	0.07
275.	25	University of New South Wales: Hand Book Life Sciences	Australia	4	0.07
276.	25	Aquatic ecosystem Health and Management	USA	4	0.07
277.	25	Aspect of pant Sciences	India	4	0.07
278.	25	Australian Journalism of Intelligent Information processing System	Australia	4	0.07
279.	25	Biosciences	France	4	0.07
280.	25	Bioelectronics and Biosensors	UK	4	0.07
281.	25	Biology in Action	Australia	4	0.07
282.	25	Bulletin Cal. Mathematics Society	USA	4	0.07
283.	25	Collectanea Mathematica	Spain	4	0.07
284.	25	Calcutta Statistical association Bulletin	Japan	4	0.07
285.	25	Cancer	USA	4	0.07
286.	25	Catalysis Surveys From Asian	USA	4	0.07
287.	25	Cereal Chemistry	USA	4	0.07
288.	25	Chemical Research in Chinese	China	4	0.07

		Universities			
289.	**25**	Chemical Geology	Netherlands	4	0.07
290.	**25**	Chemische Technik :technische chemise	Germany	4	0.07
291.	**25**	Chemistry in Australia	Australia	4	0.07
292.	**25**	Chinese chemical letters : preliminary chemical	China	4	0.07
293.	**25**	Chromosome :preliminary chemical communications in English	Japan	4	0.07
294.	**25**	Chronique de la Recherché Miniere	France	4	0.07
295.	**25**	Clinical Microbiology and Infection	USA	4	0.07
296.	**25**	Clinical Anatomy	Netherlands	4	0.07
297.	**25**	Colloids. Surfaces :physicochemical and Engineering Aspects	Netherlands	4	0.07
298.	**25**	Colorectal disease	Netherlands	4	0.07
299.	**25**	Computer Talk	USA	4	0.07
300.	**25**	Corrosion science :journal on Environmental degradation of material	UK	4	0.07
301.	**25**	Contraception	USA	4	0.07
302.	**25**	Current Microbiology	USA	4	0.07
303.	**25**	Current Opinion in Cosmetic Dentistry	UK	4	0.07
304.	**25**	Diabetic Medicine : journal of diabetes	UK	4	0.07
305.	**25**	Diagnostic Microbiology Infection Disease	UK	4	0.07

306.	26	Drug Development and Industrial pharmacy	USA	3	0.05
307.	26	European Journal of pharmaceutical	Netherlands	3	0.05
308.	26	Egypt Journal Geology	Egypt	3	0.05
309.	26	Egyptian Journal for Chest diseases and Tuberculosis	Egypt	3	0.05
310.	26	Mathematic Didatica	Germany	3	0.05
311.	26	Immunology and Medical	Netherlands	3	0.05
312.	26	Fitoterapia : journal for study of medical plant	Netherlands	3	0.05
313.	26	Forensic Science International	Ireland	3	0.05
314.	26	Fractional Calculus & Applied Analysis	Bulgaria	3	0.05
315.	26	Functional Analysis and application	Russian	3	0.05
316.	26	Geochim Cosmochim, Acta	UK	3	0.05
317.	26	Global Journal of Medical Sciences	Nigeria	3	0.05
318.	26	Health Care	India	3	0.05
319.	26	Heart & Lung :the journal of actor and critical car	USA	3	0.05
320.	26	Hemoglobin	USA	3	0.05
321.	26	Hydrobiologia :the international journal limnology and marine sciences	Netherlands	3	0.05
322.	26	India &Eastern Pharmacy	India	3	0.05
323.	26	International Journal of Oral Maxillofacial Implants	USA	3	0.05
324.	26	International Journal Pest management	UK	3	0.05
325.	26	International Journal of Nursing	UK	3	0.05

		Studies			
326.	26	International Journal Theoretical Physics	USA	3	0.05
327.	26	International Journal of Legal medicine	Germany	3	0.05
328.	26	International Conference in Physics of Condensed matter	USA	3	0.05
329.	26	International Journal of epidemiology	UK	3	0.05
330.	26	International Journal of Consumer Studies	UK	3	0.05
331.	26	International Journal of Infection Diseases	Canada	3	0.05
332.	26	International Journal of Remote Sensing	UK	3	0.05
333.	26	International Journal of Renewable Energy	Canada	3	0.05
334.	26	International Modal Analysis Conference	USA	3	0.05
335.	26	Iraqi Journal Chemistry	Iraq	3	0.05
336.	26	Iraqi Geological Journal	Iraq	3	0.05
337.	26	Issues in Mental Health Nursing	USA	3	0.05
338.	26	Journal Nephrol	Italy	3	0.05
339.	26	Journal clinical Investigation	USA	3	0.05
340.	26	Journal Different Equations an Application	UK	3	0.05
341.	26	Journal Ethnophamacology	Ireland	3	0.05
342.	26	Journal of Experimental and Clinical Cancer Research	Italy	3	0.05
343.	26	Journal Facial and Somatoprosthetics	USA	3	0.05
344.	26	Journal Flow, Injection Analysis	Japan	3	0.05

345.	**26**	Journal Food Science Technology	India	3	0.05
346.	**26**	Journal Inclusion Phenomena and mocrocyelic chemistry	Netherlands	3	0.05
347.	**26**	Studies in Applied (molden)	USA	3	0.05
348.	**26**	Journal Molecular Structure (Theo. Chem.)	Netherlands	3	0.05
349.	**26**	Journal Physics B: at Mol. Opt. Physics	UK	3	0.05
350.	**26**	Journal Science Computer	USA	3	0.05
351.	**26**	Journal Surfactants & Detergents	USA	3	0.05
352.	**26**	Journal Vetenary Medical Science	Japan	3	0.05
353.	**26**	Journal of Advances in Modelling and Analysis & Slim	France	3	0.05
354.	**26**	Journal of Clinical Pharmacology and Therapeutics	UK	3	0.05
355.	**26**	Journal of Applied spectroscopy	USA	3	0.05
356.	**26**	Journal Veterinary Parasitology	India	3	0.05
357.	**26**	Journal Fertility Counseling	UK	3	0.05
358.	**26**	Journal Sedimentary Research	USA	3	0.05
359.	**26**	Journal of Advance in Agricultural Research	India	3	0.05
360.	**26**	Journal of Agricultural Science	UK	3	0.05
361.	**26**	Journal of Symbolic Logic	USA	3	0.05
362.	**26**	Journal of comparative Behavioral Neuroscience	USA	3	0.05
363.	**26**	Journal of the Indian Statistical Association	India	3	0.05
364.	**26**	Journal of Aging and Health	USA	3	0.05
365.	**26**	Journal of Applied	Netherlands	3	0.05

		Electrochemistry			
366.	**26**	Journal of Applied Microbiology	UK	3	0.05
367.	**26**	Journal of Applied Thermal Engineering	UK	3	0.05
368.	**26**	Journal of Atmospheric Chemistry	Netherlands	3	0.05
369.	**26**	Journal of Chemotherapy	Italy	3	0.05
370.	**26**	Journal of Contemporary Dental Practice	USA	3	0.05
371.	**26**	Journal of Crop Improvement	USA	3	0.05
372.	**27**	Journal of Dental Education	Peru	2	0.03
373.	**27**	Journal of Ecology	UK	2	0.03
374.	**27**	Journal of Food Engineering	India	2	0.03
375.	**27**	Journal of Gerontological Nursing	USA	2	0.03
376.	**27**	Journal of Horticulture Science Biotechnology	UK	2	0.03
377.	**27**	Journal of Interdisciplinary Biology	USA	2	0.03
378.	**27**	Journal of Micropaleontology	Korea	2	0.03
379.	**27**	Journal of Natural product	USA	2	0.03
380.	**27**	Journal of Orthodontics	UK	2	0.03
381.	**27**	Journal of Pharmaceutical science	USA	2	0.03
382.	**27**	Journal of Physics: A Mathematical and general	USA	2	0.03
383.	**27**	Journal of PhytoPathology	Germany	2	0.03
384.	**27**	Journal of Process Control	UK	2	0.03
385.	**27**	Journal of Pure and Applied Science	Turkey	2	0.03
386.	**27**	Journal of Russian Technology	USA	2	0.03

387.	27	Journal of Substance misuse	UK	2	0.03
388.	27	Journal of Clinical forensic Medicine	UK	2	0.03
389.	27	Journal of Composites and Technology	USA	2	0.03
390.	27	Journal of Vibration and Acoustics	USA	2	0.03
391.	27	Lamp	Australia	2	0.03
392.	27	Levant	UK	2	0.03
393.	27	Magnetic Resonance Chemistry	UK	2	0.03
394.	27	Magnetohydrodnamics	USA	2	0.03
395.	27	Materials Research Society Symposium	USA	2	0.03
396.	27	Mathematics Review	UK	2	0.03
397.	27	Medicine International	UK	2	0.03
398.	27	Journal of Modern Pharmacy	South Africa	2	0.03
399.	27	Mutagenesis	UK	2	0.03
400.	27	Mycoses	Germany	2	0.03
401.	27	NATO Science Series	Netherlands	2	0.03
402.	27	Nematologia Mediterranean	Italy	2	0.03
403.	27	Nuclear Institute and Methods in Physics Research	Netherlands	2	0.03
404.	27	Nuclear Fusion	UK	2	0.03
405.	27	Nurse Education Today	UK	2	0.03
406.	27	Organize Prepare Proceeding International	USA	2	0.03
407.	27	Oriental Journal of Chemistry	India	2	0.03
408.	27	Pan American Mathematical Journal	USA	2	0.03
409.	27	Parasite	France	2	0.03

410.	27	Parasitology	Russian	2	0.03
411.	27	Pediatric Neurosurgery	Switzerland	2	0.03
412.	27	Pertanika Journal of Science and Technology	Malaysia	2	0.03
413.	27	Pharmcien Rural	France	2	0.03
414.	27	Phytotaxonomy	Italy	2	0.03
415.	27	Phytothera Pie De larecherche ale Dratique	UK	2	0.03
416.	27	Plant Genetic resources	UK	2	0.03
417.	27	Plant and Soil : international journal on plant-soil relationships	Netherlands	2	0.03
418.	27	Planta Medica	Germany	2	0.03
419.	27	Planta Molecular Biology	Netherlands	2	0.03
420.	27	Polymer International	UK	2	0.03
421.	27	Queuing Systems	Netherlands	2	0.03
422.	27	Research in Microbiology	France	2	0.03
423.	27	STP Pharma science	Canada	2	0.03
424.	27	SUT Journal of Mathematics	Japan	2	0.03
425.	27	Scandinavian Journal of Infectious Disease	Norway	2	0.03
426.	27	Scientiae mathematicae Japanicae Journal	Japan	2	0.03
427.	27	Separation Science and Technology	USA	2	0.03
428.	27	Small ruminant Research	Netherlands	2	0.03
429.	27	Soochow Journal of Mathematics	China	2	0.03
430.	27	South African statistical Journal	South Africa	2	0.03
431.	27	Spectrochimico Acta Reviews	USA	2	0.03
432.	27	Tetrahedron : Asymmetry international journal	UK	2	0.03

433.	27	The Breast Journal	USA	2	0.03
434.	27	The Canadian Journal of chemical Engineering	Canada	2	0.03
435.	27	The Egyptian of Journal geology	Egypt	2	0.03
436.	27	Toxicology modeling	UK	2	0.03
437.	27	Vaccine	UK	2	0.03
438.	27	Wiley Series in computing	USA	2	0.03
439.	27	X-ray spectrometry	UK	2	0.03
440.	27	Zeitschrift fuer Naturforschung. B: Chemical Sciences	Germany	2	0.03
441.	27	Annals of tropical Medicine and Parasitology	UK	2	0.03
442.	27	Asian Journal of mathematics	USA	2	0.03
443.	27	Asian Journal of Andrology	China	2	0.03
444.	27	Atmospheric Environment	UK	2	0.03
445.	27	Biomed, Science Instrument	USA	2	0.03
446.	27	Canadian Mathematics Bulletin	Canada	2	0.03
447.	27	Clinical and Environmental Research	USA	2	0.03
448.	27	Communication Algebra	USA	2	0.03
449.	27	Experimental Mathematics	USA	2	0.03
450.	27	Hadronic Journal	USA	2	0.03
451.	27	International association of hydraulic Congress	Netherlands	2	0.03
452.	27	International Journal of theoretical Physics	USA	2	0.03
453.	27	International Journal of Mathematics Algorithms	USA	2	0.03
454.	27	International Journal Mathematics Education Scitech	UK	2	0.03

455.	27	International Journal of power Engineering System	Canada	2	0.03
456.	27	Journal of applied Mathematics & Computations Rep.	Korea	2	0.03
457.	27	Journal Interdisciplinary Mathematics	India	2	0.03
458.	28	Journal of magnetism and Magnetic Materials	USA	1	0.02
459.	28	Journal of Molecular Catalysis a: Chemical	Netherlands	1	0.02
460.	28	Journal of Physical Chemistry	USA	1	0.02
461.	28	Materials Science Research	India	1	0.02
462.	28	Math. Ineq. Appl.	Croatia	1	0.02
463.	28	Medical Engineering and Physics	UK	1	0.02
464.	28	Physiological Research	Czech re	1	0.02
465.	28	transactions of the royal Society Journal Tropical Medicine	UK	1	0.02
466.	28	Pelages	Algeria	1	0.02
467.	28	Bragabtua	Brazil	1	0.02
468.	28	Biological and Pharmaceutical Bulletin	Japan	1	0.02
469.	28	Ziva Botany	Czech	1	0.02
470.	28	Polish Journal Pathology	Poland	1	0.02
471.	28	Journal and Animal Ecology	UK	1	0.02
472.	28	Journal of Ecology	UK	1	0.02
473.	28	Chemical list	Czech	1	0.02
474.	28	Chemical papers	Slovakia	1	0.02
475.	28	Chemical Weekly	India	1	0.02
476.	28	Indicator	USA	1	0.02
477.	28	Russina Journal of General Chemistry	Russia	1	0.02

478.	28	Journal of Coordination Chemistry	UK	1	0.02
479.	28	Powder Cotings	USA	1	0.02
480.	28	The Methematics Education	India	1	0.02
481.	28	Mobius	Australia	1	0.02
482.	28	Canadian Mathematical Society	Canada	1	0.02
483.	28	Kybeinetika	Czech	1	0.02
484.	28	Studi Logica	Netherlands	1	0.02
485.	28	Algebra universalis	Switzerland	1	0.02
486.	28	Quarterly Journal of Mathematics	UK	1	0.02
487.	28	Living Society	Australia	1	0.02
488.	28	Annals of Forest Science	France	1	0.02
489.	28	Ambio forest \Science	Sweden	1	0.02
490.	28	Biodynamics	USA	1	0.02
491.	28	Environment Action	USA	1	0.02
492.	28	Health	Australia	1	0.02
493.	28	Bush Fire bulletin	Australia	1	0.02
494.	28	Revista de Saudia public	Brazil	1	0.02
495.	28	Polizei Journal	Germany	1	0.02
496.	28	Haryana Health Journal	India	1	0.02
497.	28	Public health (Basingstoke)	UK	1	0.02
498.	28	Engineering Ciencia	Argentina	1	0.02
499.	28	Royal Society of Western Australian Journal	Australian	1	0.02
500.	28	Accelerator	Canada	1	0.02
501.	28	Wood Buck	Canada	1	0.02
502.	28	Acta Amazonica	Brazil	1	0.02
503.	28	Australian Journal of pharmacy	Australia	1	0.02

504.	**28**	Pharmacien Rural	France	1	0.02
505.	**28**	Nuclear Fusion	UK	1	0.02
506.	**28**	Annals heri prncare	Switzerland	1	0.02
507.	**28**	Physics in Medicine Biology	UK	1	0.02
508.	**28**	Zhurnal Tekhnichoskoi Fiziki	Russian	1	0.02
509.	**28**	International Journal of magnetism	UK	1	0.02
510.	**28**	Physics –uspiki	UK	1	0.02
511.	**28**	The land	Australia	1	0.02
512.	**28**	Queen stand Agricultural Journal	Australia	1	0.02
513.	**28**	Fram Trade	UK	1	0.02
514.	**28**	Andhra Agricultural Journal	India	1	0.02
515.	**28**	Agricultural cooperative Bulletin	Switzerland	1	0.02
516.	**28**	Coalminer	Australia	1	0.02
517.	**28**	Today in mining	Canada	1	0.02
518.	**28**	International Mining Seminars	UK	1	0.02
519.	**28**	American Mineralogist	USA	1	0.02
520.	**28**	Lamp	Australia	1	0.02
521.	**28**	Nursing BC	Canada	1	0.02
522.	**28**	Nursing update	South Africa	1	0.02
523.	**28**	Nursing Research Report	USA	1	0.02
524.	**28**	Nursing Education perspectives	USA	1	0.02
			Total	5880	99.8

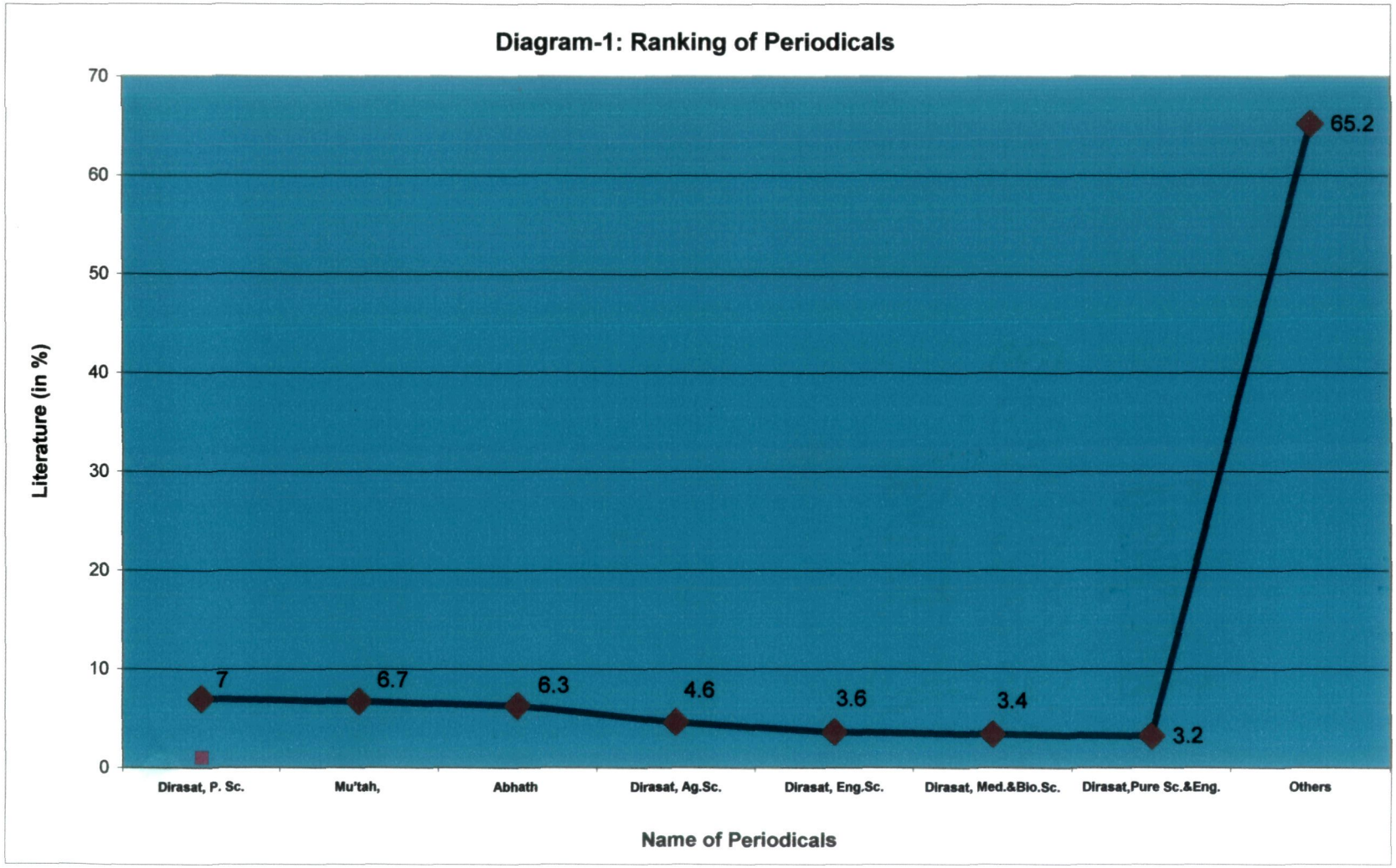
Diagram-1: Ranking of Periodicals
Literature (in %)
70
60
50
40
30
20
10
0
7
6.7
6.3
4.6
3.6
3.4
3.2
65.2
Dirasat, P. Sc.
Mu'tah,
Abhath
Dirasat, Ag.Sc.
Dirasat, Eng.Sc.
Dirasat, Med.&Bio.Sc.
Dirasat,Pure Sc.&Eng.
Others
Name of Periodicals

Table : 6.1 (B) Showing Range of Frequency

S.No.	Freq. Range	No. of Periodicals	No. of Items	%age	Cumu. %age
1.	371-406	3	1168	19.86	19.86
2.	186-266	4	859	14.60	34.46
3.	30-33	12	369	6.27	40.73
4.	20-29	27	650	11.05	51.78
5.	16-18	41	694	11.80	63.58
6.	10-14	81	951	16.17	79.75
7.	05-08	95	584	9.93	89.68
8.	01--04	261	605	10.28	99.96
	Total	**524**	**5880**	**99.96**	

Table 6.1(A) and 6.1(B) show that most of the literature on Science & Technology was published by the faculty members of Jordanian Universities in three journals namely:-

(1) 'Dirasat, Pure Sciences'

(2) 'Mu'tah, Journal for Research and Studies'

(3) 'Abhath Al-Yarmouk'

because a total number of 1168 items constituting 19.86% of the total has appeared in these periodicals. They may thus be regarded as 'Core Journals' in the terminology of Bradford's Law.

The Table 6.1(B) also shows 4 journals with their frequency of occurrence in the range of 186 to 266. It means 34.46% of the total literature was published in seven periodicals. The remaining literature by the faculty members appeared in as many as 519 journals. It is therefore obvious that seven journals are the 'Core Journals' and for finding almost an equal number of articles one has to consult quite a

large number of journals in the successive zones. This is in accordance with 'Bradford's law of scattering'.

The present ranking list will be useful for the librarian in taking policy decision regarding the subscription list of periodicals. It will be equally important for the Documentalists / Information Scientist in preparing an exhaustive documentation list on the output of S&T literature by the faculty members of Jordanian Universities.

Diagram-2: Range of Frequency

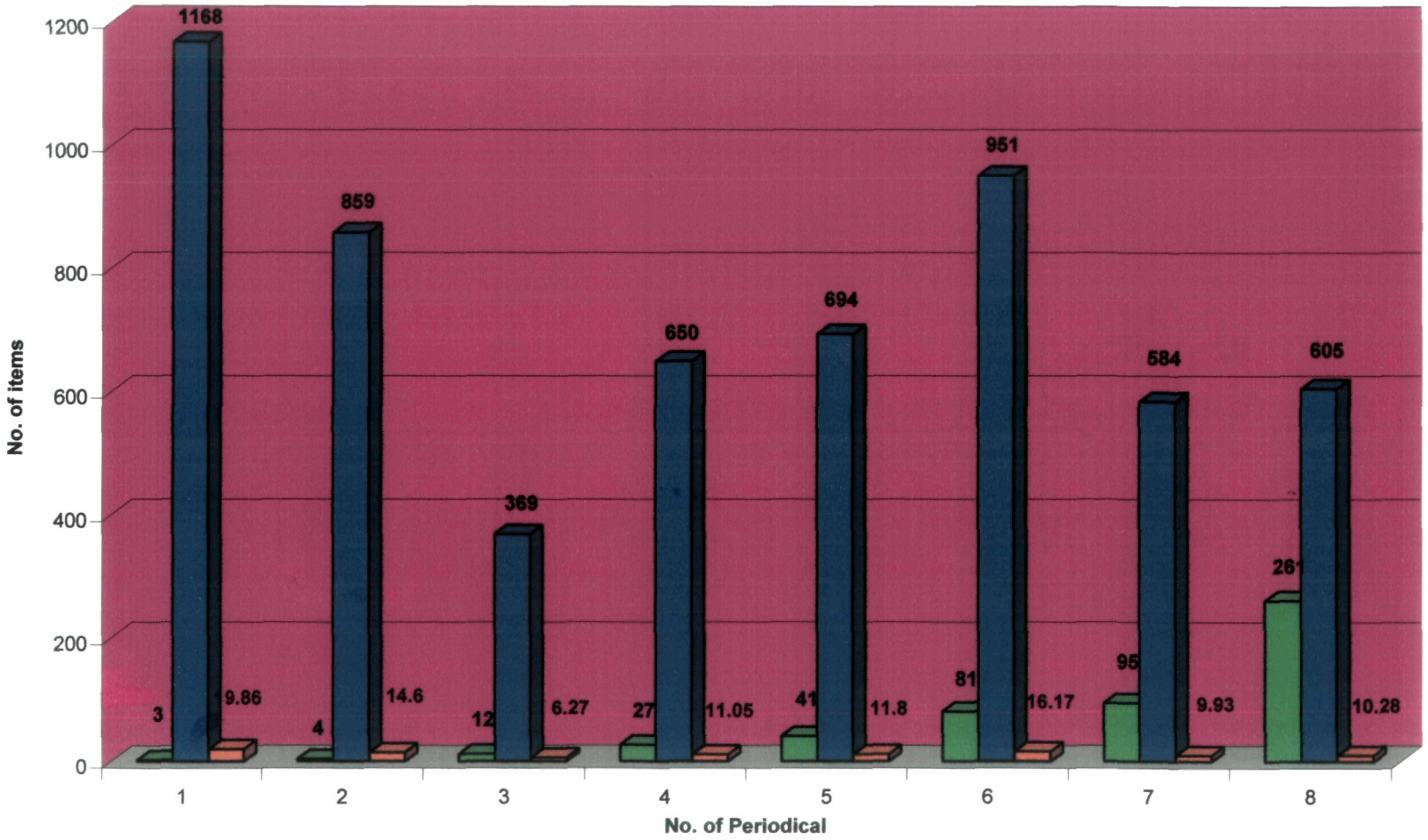

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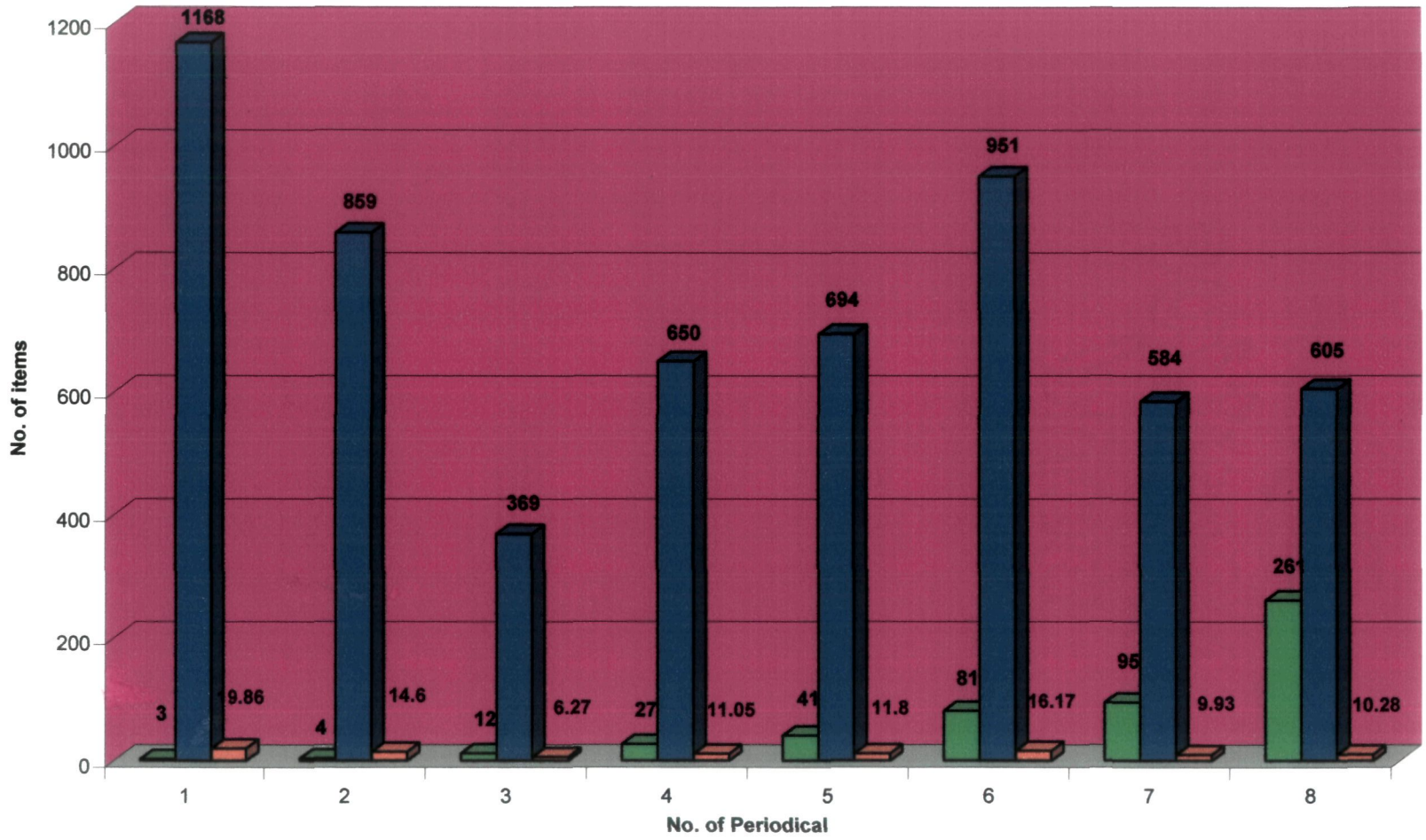
Diagram-2: Range of Frequency



6.2 Country-wise distribution

The place of publication plays an important role sometimes to judge the value of the publications and also some times as an individualizing element, especially in case of cataloguing of publications issued from institutions or conferences. Place constitutes an important element as a part of imprint in descriptive cataloguing of the publication. Apart from this, place is also important in the publications that form parts of a series.

Periodicals are the sources of current information and serve the academic community in general and research scientists in particular. The researchers/ scientists look for the recent developments in their own fields in leading periodicals. As the research areas of scientists are specialized, the periodicals providing current information to them are also specialized. In other words there are certain core journals in every specialized field of knowledge. However, it is also a fact that the research output of a given country in a given subject is more as compared to others. The reasons are not far to seek because there may be certain socio-economic - political- strategic compulsions for the countries to provide funding for research and development in a particular subject. It is therefore, obvious that some countries are the leaders in scientific publications on a given subject.

This information is of paramount importance for the Researchers as well as Information Scientists. The information is useful for the researchers' scientists because they always look for the leading periodicals in their own specialized subjects for the purpose of reference to the literature and also for the publication of their own research. Scientists are also interested to know the leading research laboratories / institutes / university departments where the current research is being conducted in their own field. As far as Librarians / Information Scientists are concerned, place of publication of documents might help in

preparing the subscription list of the periodicals, so that the resources of the library be put to the maximum use.

Table 6.2 represents a total of 51 countries where from the scientific literature of the faculty members of Jordanian universities are published. The table presents a ranked list of the countries prepared on the basis of frequency of occurrence of items in the scientific journals /Conference proceedings/ books.

The table not only shows the leading countries with the scientific output of Jordanian scholars but also shows their interest of publishing in widely distributed periodicals from as many as 51 countries.

The table also indicates that a majority of the faculty members prefer to publish their scholarly contributions in the journals originated from their native country. The table indicates that a sizeable number of items totaling about 35.74% have been published in the Jordanian periodicals. The next preference is given to American journals with 21.89% of publications. UK, Netherlands, India come next in the list constituting 10.37%, 5.00% and 3.93% of the total publications respectively.

The preference of the Jordanian Scholars is, probably due to the fact that they write both in English as well as in Arabic.

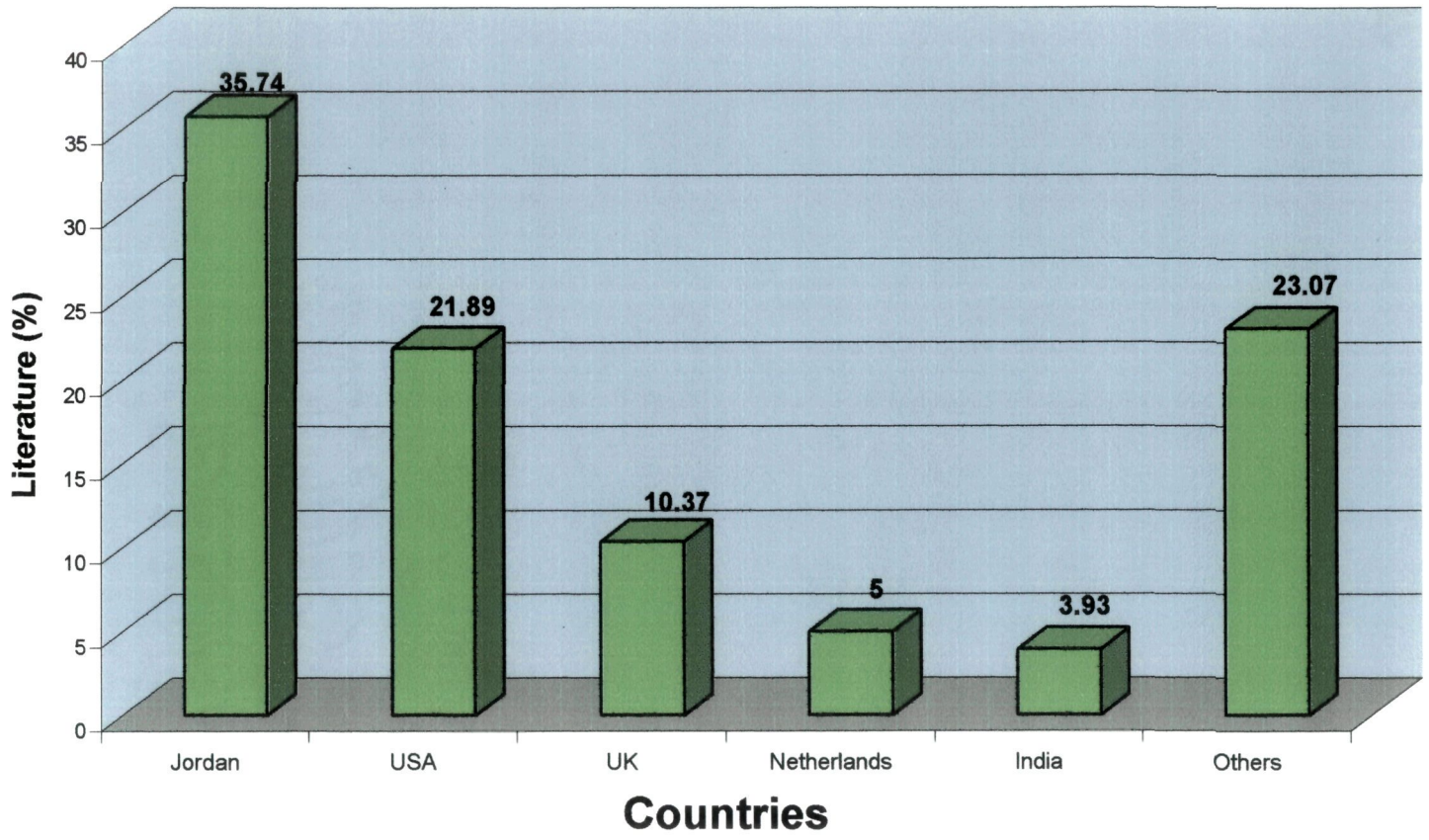
Table: 6.2(A) Country-wise Distribution

S. No.	Rank	Name of Country	Freq. of Occurrence	%age
1	1	Jordan	2274	35.74
2	2	USA	1393	21.89
3	3	UK	660	10.37
4	4	Netherlands	318	5.00
5	5	India	250	3.93
6	6	Germany	240	3.77

7	7	Egypt	135	2.12
8	8	Saudi Arabia	114	1.79
9	9	Japan	78	1.22
10	10	Australia	77	1.21
11	11	Italy	72	1.13
12	12	Turkey	66	1.03
13	13	France	55	0.86
14	14	Switzerland	52	0.81
15	15	Bulgaria	48	0.75
16	15	Russia	48	0.75
17	16	Canada	38	0.59
18	17	Sweden	37	0.58
19	18	Hungary	32	0.50
20	19	Ireland	31	0.48
21	20	Belgium	29	0.45
22	21	Iraq	28	0.44
23	21	Slovakia	28	0.44
24	22	China	23	0.36
25	23	Syria	22	0.34
26	24	Poland	21	0.33
27	25	Pakistan	19	0.29
28	26	Malaysia	18	0.28
29	27	Singapore	17	0.26
30	28	South Africa	13	0.20
31	29	Qatar	12	0.18
32	30	Iran	10	0.15
33	30	Kenya	10	0.15
34	30	Emirate Arab United	10	0.15

35	30	Colombia	10	0.15
36	31	Czech	9	0.14
37	32	Lebanon	8	0.13
38	32	Hong Kong	8	0.13
39	32	Yemen	8	0.13
40	32	Denmark	8	0.13
41	33	Thailand	5	0.07
42	33	Spain	5	0.07
43	34	Bahrain	4	0.06
44	34	Korea	4	0.06
45	34	Brazil	4	0.06
46	35	Nigeria	3	0.04
47	36	Norway	2	0.03
48	36	Peru	2	0.03
49	37	Algeria	1	0.02
50	37	Argentina	1	0.02
51	37	Croatia	1	0.02
		Total	6361	99.83

Diagram-3: Country wise distribution



6. 3 Subject-wise Distribution

A subject may be defined by an area of an interest; an area in which an individual researcher or a professional works; an area in which an individual writes; an area of knowledge being studied

One may, however, come across with the different definitions and different boundaries of the subject area. We may also find that the different users and separate pieces of literature hold different perspective on a given subject. The points of diversions in perspective can be categorized into two types:-

a) different labels (names that are used for the subjects) and

b) different concepts about scope and associations with other subjects that are evident

Essentially these factors form the basis of problems in identifying a satisfactory subjects. As far as the subject content of the articles appearing in periodicals is concerned, the problem seems to be equally nagging. This is because of the fact that most of the journals do specialize in certain broad areas of the subjects, yet the articles appearing in them may not exactly fit into the subject areas as defined in the scope of the periodicals. Hence the phenomenon of "seepage" of information.

The Bradford's Law of Scattering' identifies the core journals in a given subject as also the related journals increasing proportionately for the same number of articles as in the core periodicals.

It is therefore, important to find out the subject areas of the periodicals wherein the faculty members of Jordanian Universities in Science and Technology have published "**Ulrich International Periodicals Directory"** (2004) has been used to ascertain the subject fields of the periodicals.

Table 6.3 shows subject-wise distribution of periodicals using 'Ulrich International Periodicals Directory'. The table indicates that the

faculty members of Jordanian Universities publish their scientific literature in as many as 25 subject areas in Science, Technology, Biology, Pharmacy and other fields. However, most of the literature published in science and technology constitutes 13.58% of the total. The next contribution of the faculty members is in the field of Engineering with 10.58%, followed by Mathematics with 9.91% and Medical Sciences with 9.60%. As evident from the table, the Jordanian Faculty members are more interested in science and technology, that is of more general in nature as compared to more recently developed subjects like Plastic and Ceramic etc. with only 0.12% and 0.09% of the total literature respectively. It is probably because of the fact that new department of studies dealing with newly developed subjects are yet to come of age.

TABLE 6.3 : Subjects – wise Distribution

S.No.	Rank	Subject Area	freq	% freq
1	1	Science and Technology	864	13.58
2	2	Engineering	673	10.58
3	3	Mathematics	631	9.91
4	4	Medical Science	611	9.60
5	5	Sciences	597	9.38
6	6	Agriculture	466	7.32
7	7	Chemistry	402	6.31
8	8	Computers	288	4.52
9	9	Electronics	282	4.43
10	10	Physics	263	4.13
11	11	Biology	229	3.60
12	12	Earth Science	218	3.42
13	13	Pharmacy and Pharmacology	186	2.92
14	14	Dentistry	140	2.20

15	15	Microbiology	130	2.04
16	16	Environmental	96	1.50
17	17	Botany	72	1.13
18	18	Nurses And Nursing	53	0.83
19	19	Energy	42	0.66
20	20	Public Health	36	0.56
21	21	Biochemistry	26	0.40
22	22	Veterinary	25	0.39
23	23	Mines and Mining Industry	17	0.26
24	24	Plastic	8	0.12
25	25	Ceramic	6	0.09
		Total	**6361**	**99.88**

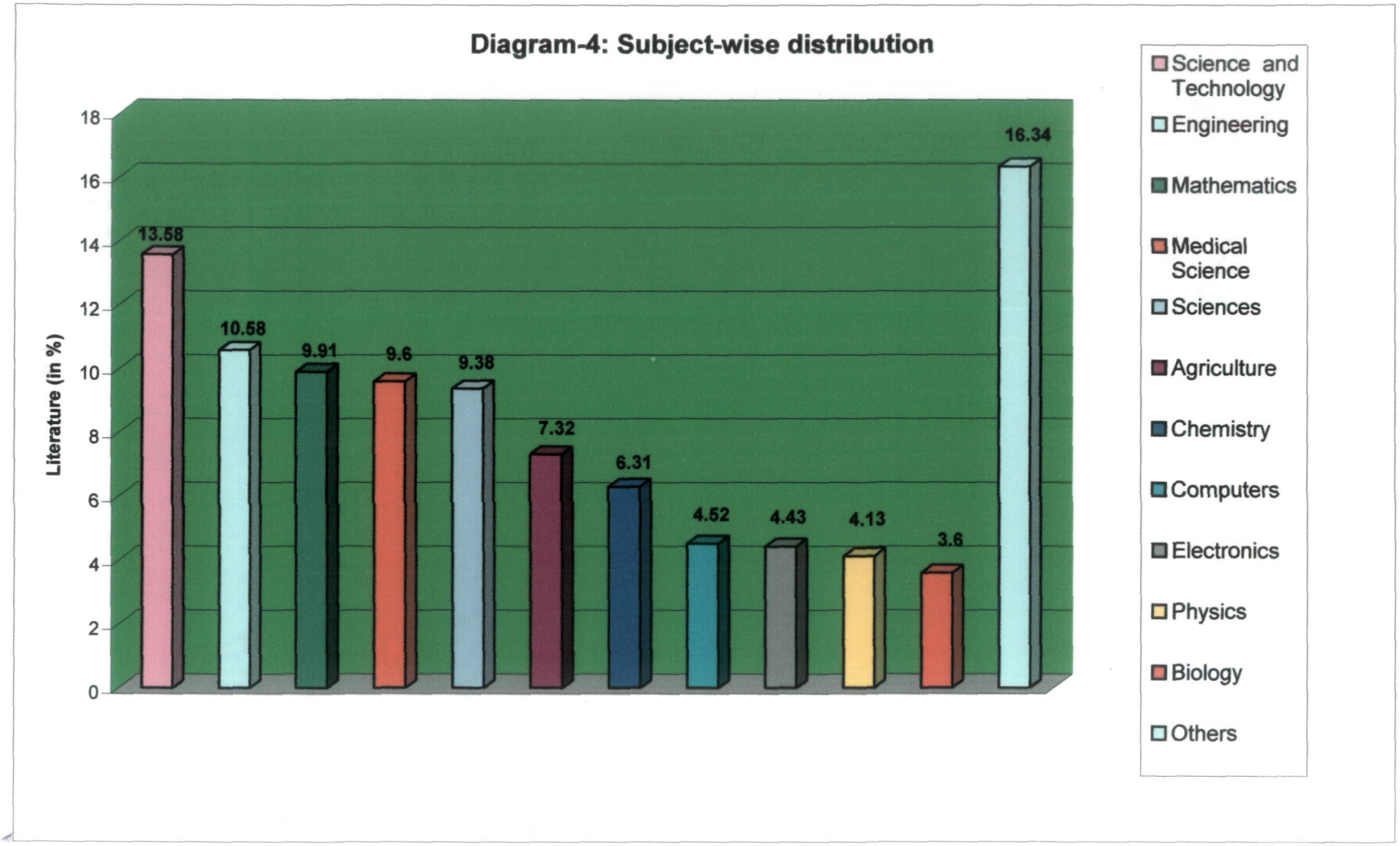


Diagram-4: Subject-wise distribution
Literature (in %)
0
2
4
6
8
10
12
14
16
18
13.58
10.58
9.91
9.6
9.38
7.32
6.31
4.52
4.43
4.13
3.6
16.34
Science and Technology
Engineering
Mathematics
Medical Science
Sciences
Agriculture
Chemistry
Computers
Electronics
Physics
Biology
Others

6.4 Language-wise Distribution

The language of document plays an important role in scientific communication between the producer and user of information. A scientist would like to use a document effectively and conveniently in his own language. Documents in unfamiliar or less familiar languages are unlikely to be used, thus retarding the dissemination of information.

Despite of developments in ICT and other facilities to promote free flow of information, the language is still a barrier in information communication.

A number of efforts have been made at different levels by different organizations to over come the problem of language barrier. Contribution by UNESCO and International Translation Centre to over come the language barrier is well known. Since 1949, UNESCO has been bringing out annually the 'Index Translationum' which lists translated books in all subjects from various countries of the world into all languages. The references in the Index are arranged in order of the French names of the countries, subdivided by ten main divisions of U.D.C. It is a cooperative effort and data is supplied by each participating country. ITC was set up by 'European Productivity Agency'. Its aim is to exchange information about translations and to prevent duplication of translation work. ITC notifies translations through the 'World Trans Index' being published since 1978. This Index gives the list of journals which are currently translated. ITC has a sizeable collection of translations (Prasher, R.G., 2003)[2].

The researchers / scientists know the language in which they prefer to publish. They are also aware of the sources of information from where they get latest information for their own research purposes. However, there is always a possibility of existence of various other sources of information of their interest but in the languages, not known to a given researcher. It is therefore, important to know the languages in which the information in one's own area of specialization is published,

so that, they may keep track with the relevant information. The present study appertains to ranking of languages in which faculty members of Jordanian University have authored their scientific publications.

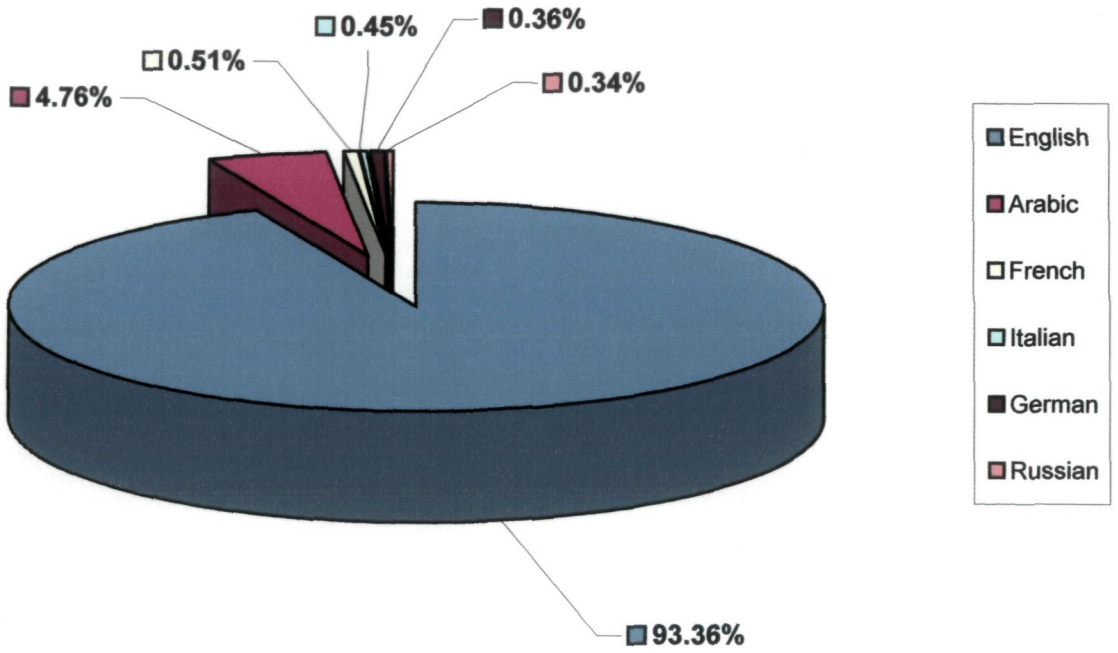
Table 6.4(A) Indicates the frequency of occurrence of 6361 items published by the faculty members of Jordanian University in S&T in different languages. English was found to be the most preferred language of scientific communication, as the faculty members produced 93.36% of the total items in English language. The second language of preference of the Jordanian scholars is Arabic constituting only 4.76% of the total. All other languages of publications, like French, Italian, German, Russian, Dutch, Japanese and Slovak constitute less than 1 percent each.

Although the native language of the Jordan is Arabic but the specialists in S&T are well efficient in English language. English being the most preferred language of communication among Jordanian scholars is probably because the English language has worldwide acceptability and most of the scientific literature of research value is published in English language journals only. However, when publications by Jordanian faculty members in language, other than English and Arabic are in a very small proportion. They are also translated into English.

Table 6.4 (A): Language-wise Distribution

S.No.	Rank	Name of Language	Freq.	Freq. %age	Cummu. Freq. %age
1.	1	English	5939	93.36	93.36
2.	2	Arabic	303	4.76	98.12
3.	3	French	33	0.51	98.63
4.	4	Italian	29	0.45	99.08
5.	5	German	23	0.36	99.44
6.	6	Russian	22	0.34	99.78
7.	7	Dutch	8	0.12	99.90
8.	8	Japanese	3	0.04	99.94
9.	9	Slovak	1	0.01	99.95
	Total			**6361**	**99.95**

Diagram 5: Language-wise distribution



The language wise distribution may also be studied from a different angle, as shown in table 6.4(B).

The Jordanian scholars in S&T have published in 524 journals of which, 468 periodicals (i.e. 89.31%) are published in English language only and 27 periodicals (i.e. 5.15%) are published in English and Arabic both. However, only in 14 periodicals (i.e. 2.67%), they publish their literature in English as well as in any other language except Arabic. The publications in languages other than English and Arabic have appeared only in 15 periodicals (i.e. 2.86%).

Table 6.4(B) Language of Periodicals

S.No	Language of Periodicals	Number of Periodicals	Percentage
1	English	468	89.31
2	English and Arabic	27	5.15
3	English and another (other than Arabic)	14	2.67
4	Other Language only	15	2.86
	Total	**524**	**99.99**

From the above two tables it may thus be concluded that Faculty members of Jordanian Universities of S&T, publish their literature in as many as 524 journals. Though most of their publications are limited to the journals that publish in English and Arabic (i.e. those published from Arab World) yet 93.36% of their publications are in English, irrespective of the fact from where they are brought out.

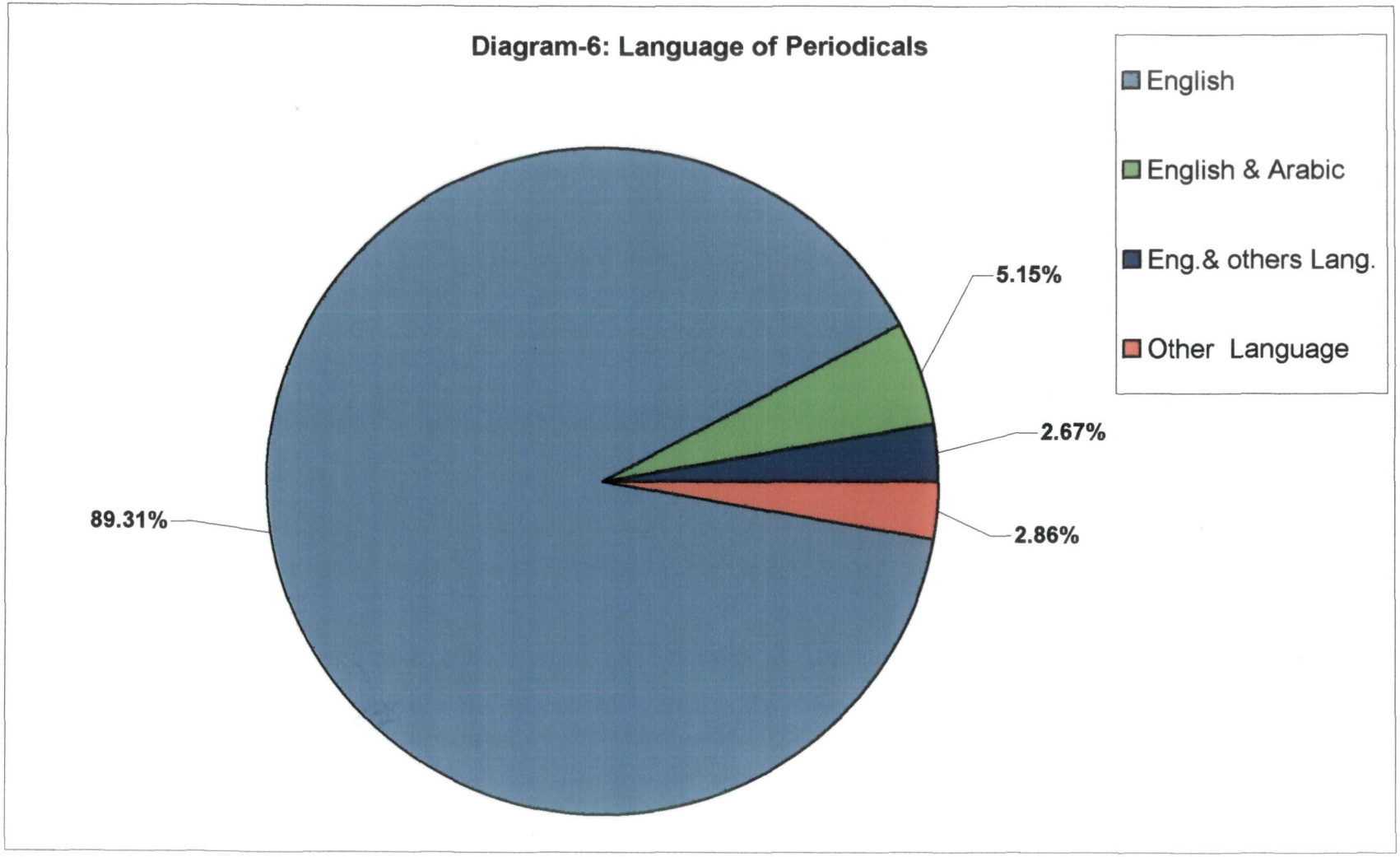


Diagram-6: Language of Periodicals
English
English & Arabic
Eng.& others Lang.
Other Language
5.15%
2.67%
2.86%
89.31%

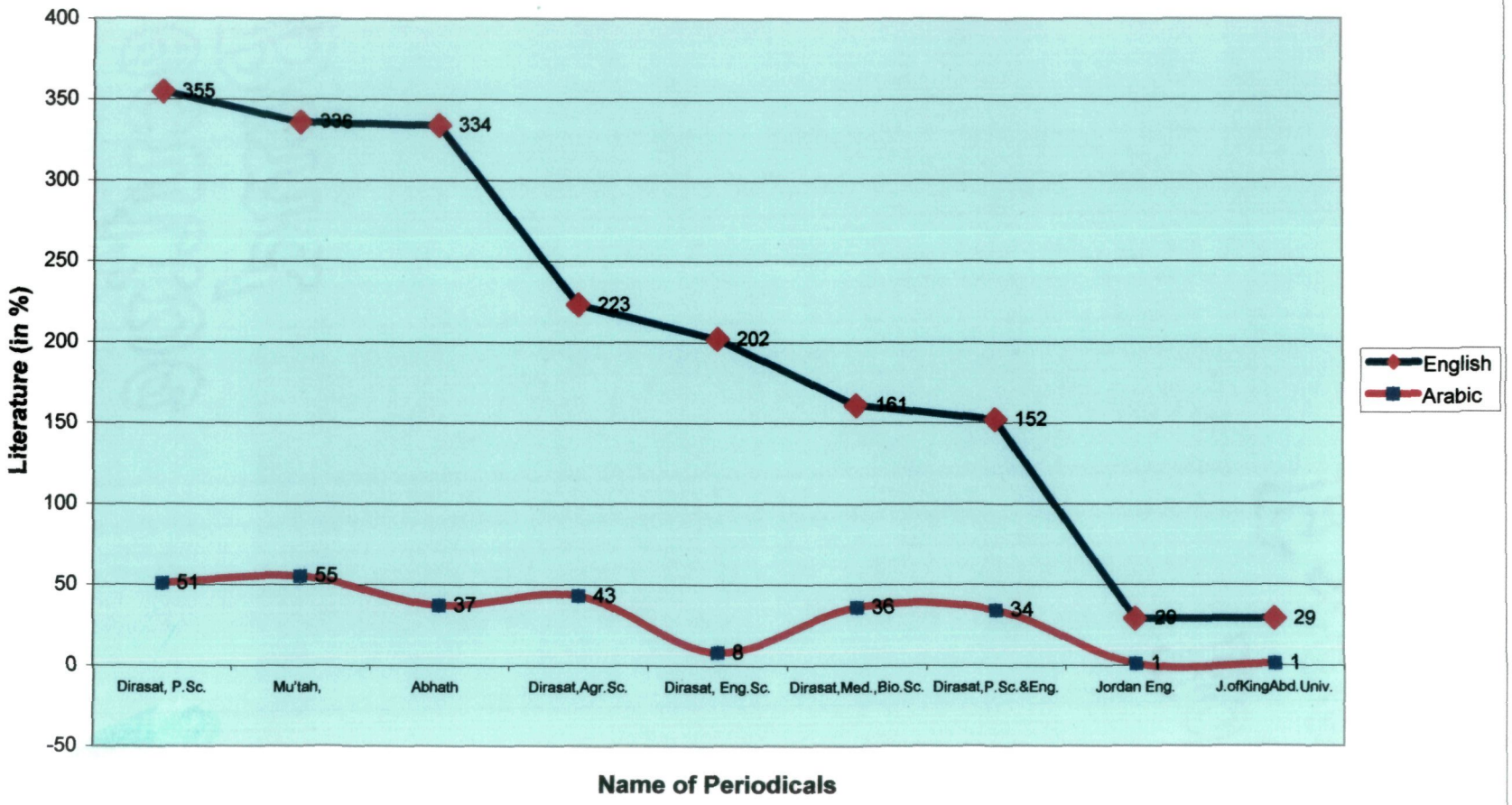
Table 6.4(C) further strengthens the above findings. The table gives a list of journals that publish both in English as well as Arabic. It is interesting to observe that out of 2231 Items published in these journals, 1965 items (88.08%) were published in English language whereas the remaining 266 items (11.92%) were published in Arabic language.

Table: 6.4 (C) Periodicals publishing in English and Arabic

S. No.	Name of Periodicals	Place of Publication	Item published in		Total
			English	Arabic	
1.	Dirasat, Pure Sciences	Jordan	355	51	406
2.	Mu'tah, Journal for Research and studies	Jordan	336	55	391
3.	Abhath Al-Yarmouk	Jordan	334	37	371
4.	Dirasat, Agricultural Science	Jordan	223	43	266
5.	Dirasat, Engineering Science	Jordan	202	8	210
6.	Dirasat, Medical and Biological Sciences	Jordan	161	36	197
7.	Dirasat ,Pure Science and Engineering	Jordan	152	34	186
8.	Jordan Engineering	Jordan	29	1	30
9.	Journal of King Abdulaziz University	Saudi Arabia	29	1	30
10.	Egyptian Dental Journal	Egypt	17	0	17
11.	Alexandria Journal of pharmaceutical Sciences	Egypt	17	0	17
12.	Alexandria dental Journal	Egypt	14	0	14
13.	Damascus University Journal for Health Science	Syria	14	0	14
14.	Eastern Mediterranea Health Journal	Egypt	11	0	14
15.	Qatar University Science Journal	Qatar	10	0	10
16.	Aden Journal of Natural and applied Sciences	Yemen	8	0	8

17.	Caro Dental Journal	Egypt	**7**	**0**	**7**
18.	Egypt. Journal of Microbiology	Egypt	**6**	**0**	**6**
19.	Emirates Journal of Agricultural Science	Emirate Arab United	**6**	**0**	**6**
20.	Iraqi Journal of Science	Iraq	**6**	**0**	**6**
21.	Iraqi Dental Journal	Iraq	**6**	**0**	**6**
22.	Al-Azhar bulletin of Science	Egypt	**5**	**0**	**5**
23.	Al-Basra Cervical	Iraq	**5**	**0**	**5**
24.	Annals of Agricultural Science	Egypt	**4**	**0**	**4**
25.	Egypt Journal Geology	Egypt	**3**	**0**	**3**
26.	Egyptian Journal for Chest diseases and Tuberculosis	Egypt	**3**	**0**	**3**
27.	The Egyptian of Journal geology	Egypt	**2**	**0**	**2**
		Total	**1965**	**266**	**2231**
		%	88.08	11.92	100

Diagram-7: Periodicals publishing in English & Arabic



6.5 Year-wise Distribution

The importance of periodicals basically lies in the currency of information. It is for this reason information contained in the periodicals forms the basis of modern day scientific research. The research may be conducted either by individual or by a team of scientists, but the importance of current information as reported in periodicals' articles, can hardly be over emphasized. However, it is important to know the period in which most of the researches have been conducted by the faculty members of Jordanian Universities.

Table No. 6.5 gives the year wise productivity of the Jordanian scholars during the period under study. The table indicates a steady growth in the production of literature by Jordanian scientists as it shows only 384 items in 1995. The number gradually increased to 612 in the year 2000 and to 789 in the year 2005. Thus, indicating a growth rate of 9.89 from 1995 to 2000 and a growth rate of 5.33 from 2000 to 2005. A line graph (No.8) shows the steady growth in the production of scientific literature by the faculty members of Jordanian universities.

Diagram-8: Growth rate

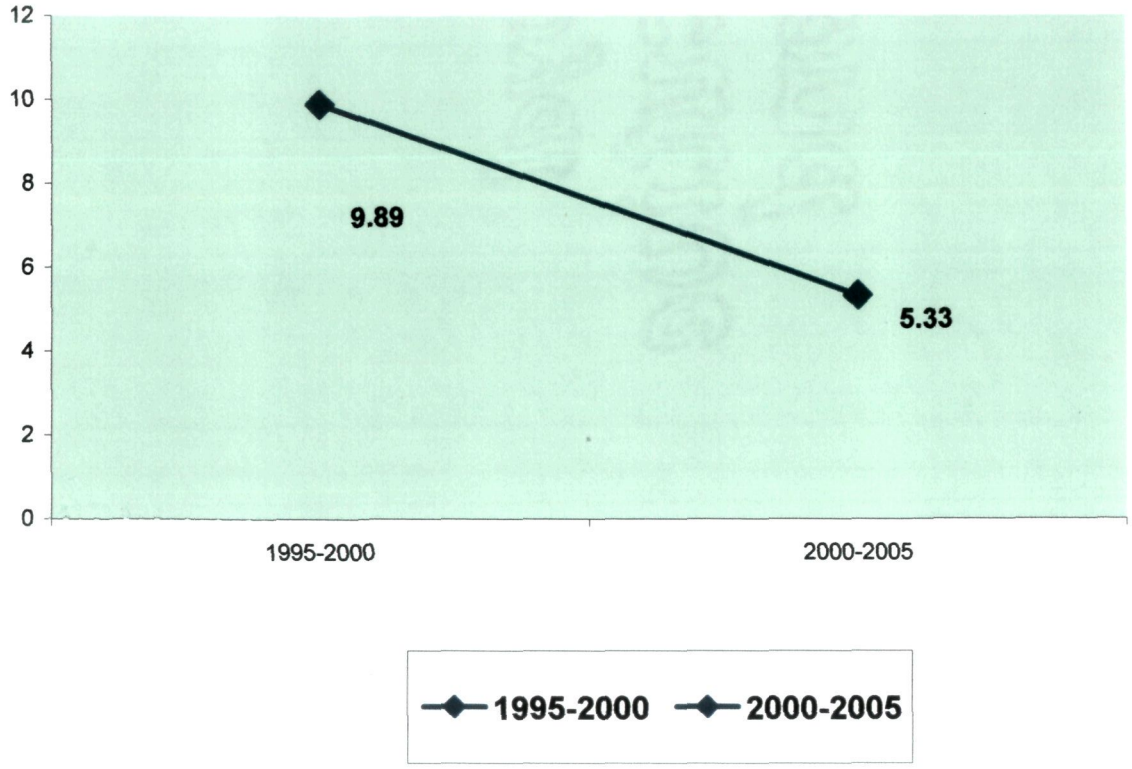


Table 6.5: Year-wise Distribution

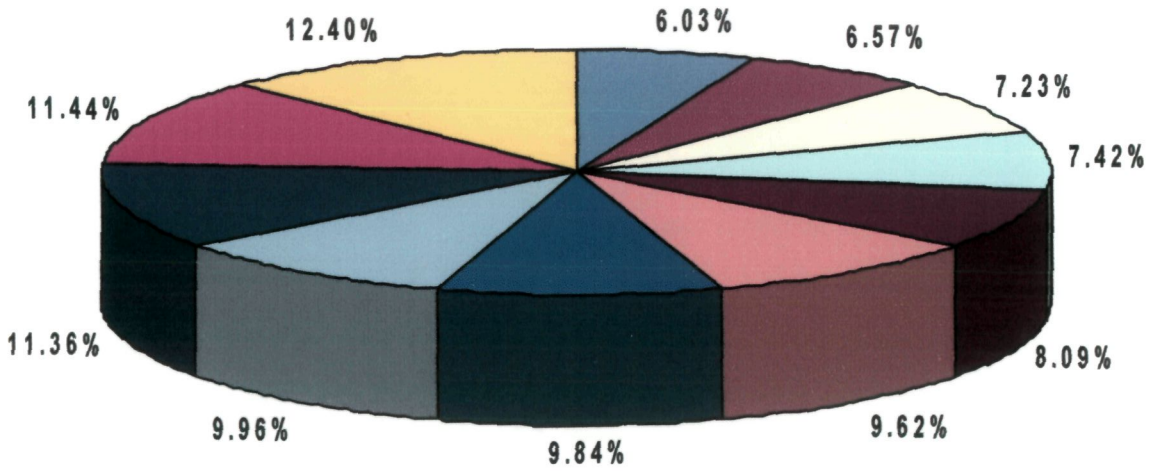
S.No.	Period of Origin	Freq. if Occurrence	Freq. %age	Cummu. Freq. %age
1.	1995	384	6.03	6.03
2.	1996	418	6.57	12.6
3.	1997	460	7.23	19.83
4.	1998	472	7.42	27.25
5.	1999	515	8.09	35.34
6.	2000	612	9.62	44.96
7.	2001	626	9.84	54.80
8.	2002	634	9.96	64.76
9.	2003	723	11.36	76.12
10.	2004	728	11.44	87.56
11.	2005	789	12.40	99.96
	Total	**6361**	**99.96**	

Taking into account the total number of publications of Jordanian Faculty members, we find from Table 6.5, that the frequency of appearance of published items is only 6.03 per cent in the year 1995 which became 9.62 per cent in the year 2000 and 12.40 per cent in the year 2005. An approximate estimate of the production of the literature by the faculty members of Jordanian Universities shows the doubling of the published output during the period 1995 to 2005.

The reason for the steady growth of scientific literature produced by Jordanian faculty members may be due to:-

i) Increase in the number of universities as also the corresponding increase in faculty members as shown below:-

Diagram-9: Year-wise distribution



S.No	Year	Number of Universities	Number of Faculty members
1	1995	5	27
2	2000	8	41
3	2005	10	50

ii) Policy of the Government to promote scientific research during the period.

iii) Personal interest of the Jordanian faculty members to get international recognition.

6. 6 Form-wise Distribution

Scientific research is published in many different forms, such as books, periodicals, conference proceedings, patents, newsletters, Bulletins, research reports etc. In fact each one of them has got its own importance in scientific communication. To have an idea about the utility of different forms, each format has been described in the following paragraphs:-

Books:- A book is a division of a literary work, which is separately published and has an independent physical existence, although its pagination may be continuous with other volumes. Books are frequently used by the scientists and technologists. When a factual problem arises in a particular subject field, books are consulted first.

Periodicals: - These make up the bulk of primary source literature of S&T. A periodical publishes original contributions and makes the latest information available on its subject. In fact research and development work is not possible without periodicals.

Conference proceedings: - These are the published records of meetings of a society or institution, frequently accompanied by the papers read or submitted.

Patents: - Patents have proven to be immensely valuable information source on invention and technology. Modern researchers and technologists emphasize their need for rapid and accurate information, Patents identify such needs.

Newsletters: - It is a manuscript report of current happenings, written for special subscribers and issued regularly or sometimes irregularly. It is now frequently published by the organizations / institutions as a brief publication conveying news.

Bulletins: May be defined as –

(i) a publication, generally a pamphlet issued by a government Society or organization at regular intervals in serial form.

(ii) A periodical or occasional publication containing lists of books added to library, and other library information.

Research Reports: - Research reports are more primitive form as they are produced earlier in the research program. These originate in the research laboratories working under an organization and are generally distributed either in microform or full size copy to all installations having interest in them.

Types of research largely determines the format in which it is published. It goes without saying that the articles in scientific journals have their own research value as compared to the articles published in conference proceedings or even books. When the scientific research needs some copyright protection with regard to composition, scientific formula or marketability, the same is patented.

The present study pertaining to 'Form wise distribution' (Table 6.6) indicates that the faculty members of Jordanian universities of Science and Technology have largely confined themselves to three form of publications only viz. articles published in the scientific journals, articles published in conference proceedings or those inform of books. It may be noted that 92.43% of the total items have been published as articles in scientific journals. The articles published in conference

proceedings (i.e. 423 items constituting 6.64%) occupy the second place and those published in form of books amount to a meager 0.91% only.

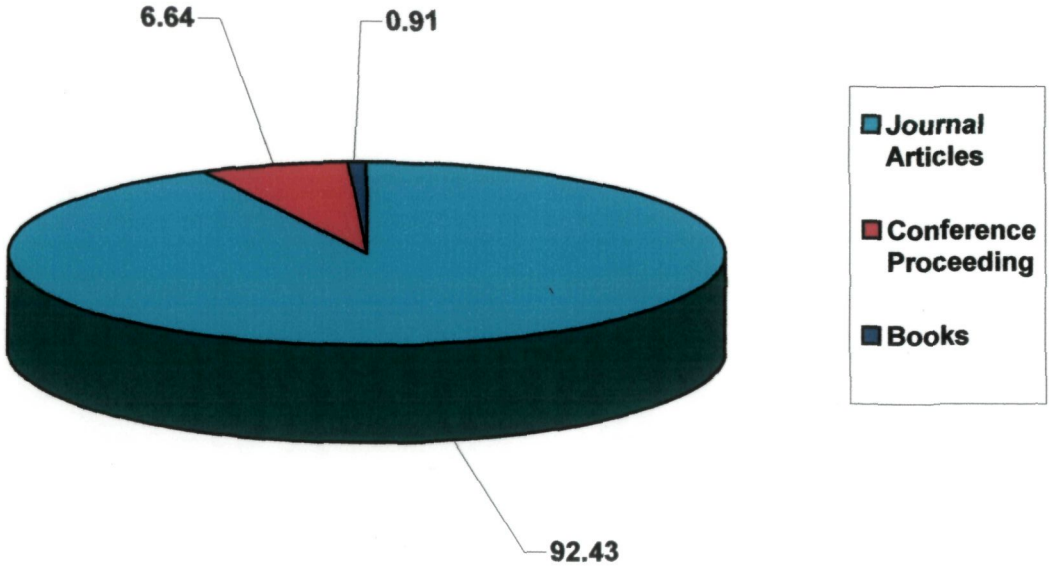
It is therefore apparent that the articles constitute the most preferred format of the Jordanian scholars. The reason seems to be obvious because they prefer to write in the journals published both in English as well as in Arabic language, for example in Dirasat, Mu'tah, Journal for research and studies, Abhath Al-Yarmok as shown in Table 6.1. As far as their second preference is concerned, most of the conferences in Science and Technology at International level are organized in Europe and America where the language of presentation is mostly in English hence conference proceedings amount to 6.64% of the total only.

As far as the publications in Book form is concerned, the readership in Arabic is quite limited. Hence, the book forms the third preference of scholars i.e. 0.91% only.

Table 6.6: Form-wise Distribution

S.No.	Rank	Name of forms	Freq.	Freq. %age	Cummu. Freq. %age
1.	1	Journal Articles	5880	92.43	92.43
2.	2	Articles published in Conference Proceedings	423	6.64	99.07
3.	3	Books	58	0.91	99.98
	Total		**6361**	**99.98**	

Diagram: 10 Form-wise distribution:



6.7 Ranking of Authors

An author is generally defined as a person or a cooperate body responsible for thought and expression of intellectual contents of a document. The author may be personal or corporate.

When the responsibility for the thought and expression rests solely in the private capacity of the author, the same is called as personal author, but when it rests on any body or organ, the same is called corporate author.

The personal authorship may appear as a single author, joint author or multiple authors; where as corporate author is differentiated into Government, Institution and Conference.

In the present study, the contributions of Jordanian scholars have been found to appear in any of the above mentioned categories that are personal or corporate.

In any given subject, authors may be categorized into three types. First, those who have established themselves as recognized authors. Second, those who had been writing for quite long but are yet to reach to a certain level as that of the first category of authors. Third, those who are novices in a given subject and have to go a long way to get themselves noticed / recognized. However, some of the authors are well known personalities in a given field and their works are regarded as classics. In the same context, one may cite the example of 'Current Contents' a premier Internationally acclaimed current awareness tool for researchers published by Thomson Scientific. It gives access to the tables of contents of the latest journals' issues published and saves the valuable time by Scientists / Researcher in locating a required piece of current information.

Science Edition of 'Current Contents' include subjects like Life Sciences, Clinical Medicine, Agriculture, Biological and Environmental Science, Engineering and Technology, Physical Chemical and Earth Science. In general, a publication cited more than 400 times is

considered as a classic. 'Current Contents' publishes 'citation classic', a highly cited publication as identified by Science Citation Index (SCI), Social Science Citation Index (SSCI) and 'Citation Classic' is a six weekly edition and one Bi-weekly edition. It includes publications selected to fit the interest of 'Citation Classic' readers.

The present study relates to the ranking of faculty members of Jordanian Universities of Science and Technology. Table 6.7(A) shows the total number of publications by different faculty members during the period of study (1995-2005). The table arranges the contribution of various faculty members and ranks them to show the most productive authors during the period of study (1995-2005) as follows:-.

a.	Jamal R. Qasem	(36) items
b.	Mustafa, H.	(33) items
c.	Abed, Abdulkader M.	(31) items
d.	Abo-Zahhad, Muhammad	(31) items
e.	Alshwabkeh, K.	(31) items
f.	Hajja, M.	(31) items
g.	Mahmood, Sami	(31) items
h.	Younis, M.S.	(31) items

It may be noted that the first rank is occupied by Jamal R. Qasem (Department of Agriculture, University of Jordan) with 36 items published to his credit. Second rank with 33 publications is occupied by Mustafa, H. (Department of Physics, University of Jordan). Third place with 31 items each is occupied by as many as six authors namely Abed, Abdulkader M. (Department of Earth Science, University of Jordan); Abo-Zahhad, Muhammad (Department of Electronics, Yarmouk University); Alshwabkeh, K. (Department of Agriculture, University of Jordan); Hajja, M. (Department of Mathematics, Yarmouk University); Mahmood, Sami (Department of Physics, Yarmouk University) and Younis, M.S. (Department of Mathematics, Yarmouk University).

Table 6.7(A): Ranking of Authors: The table lists the number of contributors of only 421authors out of a total of 3593

S.No	Rank	Name of Author	Frequency
1.	1	Jamal R. Qasem	36
1.	2	Mustafa, H	33
2.	3	Abed Aldulkader, M.	31
3.	3	Abo-Zahhad, Muhammad	31
4.	3	Alshwabkeh, K.	31
5.	3	Hajja, M.	31
6.	3	Mahmood, Sami	31
7.	3	Younis, M.S.	31
8.	4	Abumurad, K.M.	30
9.	4	Al-Bayari, O.	30
10.	4	Awad, Adnan M.	30
11.	4	Horani, Hala	30
12.	4	Jarrar, Ghaleb H.	30
13.	4	Sadiq, May F.	30
14.	4	Sharaf, Naim S.	30
15.	5	Abdel-Hafez, S.K.	29
16.	5	Abu-Jaber, N.	29
17.	5	Abu-Orabi, Sultan T.	29
18.	5	Aburjai ,T.	29
19.	5	Altee, Majid	29
20.	5	Asem A. Shehabi	29
21.	5	Mahmood, S.H.	29
22.	5	Malkawi, Hanan I.	29
23.	5	Najib Abou Karaki	29
24.	6	Abu-Hammad, Oa	28
25.	6	Al-Hanbali, N.N	28

26.	6	Amro, B.I.	28
27.	6	Hamdan, M.A.	28
28.	6	Jerrik, A.J.	28
29.	6	Laham, N.M.	28
30.	7	Abu-Awwad, Ahmad	27
31.	7	Al-Bataina, Barakat A.	27
32.	7	Alshamali, A.	27
33.	7	Duwayri, Mahmud	27
34.	7	Hadidi, K.H.	27
35.	7	Madan, K.C.	27
36.	7	Rabadi, Nasri J.	27
37.	8	Gharaibeh, S.H.	26
38.	8	Ismail, Adnan	26
39.	8	Jabarin, Amer	26
40.	8	Mansour, I.	26
41.	8	Marji, Dhib	26
42.	8	Rawabdeh, I.	26
43.	8	Salman Amer	26
44.	9	Abu-Aljarayesh, I.	25
45.	9	Al-Momani, I.F.	25
46.	9	AL-Momany, A. AL-Raddad	25
47.	9	Al-Ruzouq, R.	25
48.	9	Battah, Ah	25
49.	9	Shatanawi, Muhammad Rashid	25
50.	9	Suwwan, M.A.	25
51.	9	Yamin, H.Y.	25
52.	10	Abdelazeez, Mohamed K.	22
53.	10	Abu-Rukah, Y.	22
54.	10	Ahmed, M.S.	22

55.	10	Al-Fahoum, A.	22
56.	10	Al-Qaoud, K.	22
57.	11	Al-Smadi, A.	21
58.	11	Atallah, Muhammad	21
59.	11	Battah, A.	21
60.	12	Abu-Dayyed Walid	20
61.	12	Abu-Jabir, Nizar	20
62.	12	Aiedeh, K.	20
63.	12	Al-Agtash, S.	20
64.	12	Al-Allaf, Talal Ahmad	20
65.	12	Mustafa, Tawfiq M.	20
66.	12	Refai, M.	20
67.	13	Elayyan, H.S.B.	19
68.	13	Esmadi, F.	19
69.	13	Issam S. Jalham	19
70.	13	Mahmoud, S.	19
71.	13	Saadoun, I.	19
72.	13	Shahidehpour, S.M.	19
73.	14	Al-Hamdany, Raad	18
74.	14	Caccavale, F.	18
75.	14	Dwairi, I.M.	18
76.	14	Faqih, Ahmad M.	18
77.	14	Jaradat, Qasem M.	18
78.	14	Khader, Sudai	18
79.	14	Khalid, A.M.	18
80.	14	Lehlooh, A.	18
81.	14	Majeed H.A.	18
82.	14	Salhieh, S.	18
83.	14	Snobar, Bassam A.	18

84.	15	Abbadi, Muhammad A.	17
85.	15	Abed, Abd al-Qadir M.	17
86.	15	Al-Omari, Mohammad	17
87.	15	Al-Qudah Aa	17
88.	15	Al-Qutob, R.	17
89.	15	Al-Refaie, S.N.	17
90.	15	Al-Rhyahhel, Ahmad	17
91.	15	Al-Salihi, A.	17
92.	15	Al-Tallaq, K.	17
93.	15	Arabiat, Suleiman	17
94.	15	Ayoub, N.Y.	17
95.	15	Barqawi, Khaled R.	17
96.	15	Bayati, Abbas Yunus	17
97.	16	Abbas, Khamis	16
98.	16	Abu Salim, Ahmad	16
99.	16	Al-Bakri, J.T.	16
100.	16	Al-Fayiymi, N.	16
101.	16	Al-Jarrah, Ali	16
102.	16	Momani, S.	16
103.	16	Mustafa, Suleiman, H.	16
104.	16	Saqqa, Walid	16
105.	16	Saub, H.	16
106.	16	Shinaq, R.	16
107.	16	Swami, H.M.	16
108.	16	Tabbaa, Muhammad J.	16
109.	16	Taimeh, Awni Yaqub	16
110.	17	Fora, A.	15
111.	17	Jibril, Ibrahim	15
112.	17	Kullab, M.K.	15

113.	17	Lehlooh, Abdel-Fatah D.	15
114.	17	Younes, N.	15
115.	17	Zaghal, Mukarram, H.	15
116.	18	Buttrus, Nabil	14
117.	18	Dahab, A.	14
118.	18	Darwish, R.M.	14
119.	18	Duwairi, Hamzeh	14
120.	18	El-Abadelah	14
121.	18	Fataftah, Z.A.	14
122.	18	Gharayibah, Samih	14
123.	18	Habib, A.	14
124.	18	Harrison, A.	14
125.	18	Hoerauf, A.	14
126.	18	Ismail, A.M.	14
127.	18	Kafawin, Omar	14
128.	18	Kamhawi, S.A.	14
129.	18	Khraisha, Y.	14
130.	18	Khreis, O.M.	14
131.	18	Kullab, Mahmud	14
132.	18	Lahham, Jamil	14
133.	18	Mahmoud Abo-Shehada	14
134.	18	Maqusi, Muhammad	14
135.	18	Momani, S.M.	14
136.	18	Odeh, Issam M.	14
137.	18	Odeh, Souhil	14
138.	18	Qasem, J.R.	14
139.	18	Qrunfleh, Mostafa M.	14
140.	18	Rimawi, Omar	14
141.	18	Sabah, M.A.	14

142.	18	Sharif, AbdAllah	14
143.	18	Taha, M.O.	14
144.	18	Wahbeh, Muhammad I.	14
145.	18	Yamani, M.I.	14
146.	18	Youssef,M	14
147.	19	Abd Al-Rahman, Ya'qub Salim	13
148.	19	Abd-al-Rahman, Nabil	13
149.	19	Abderahman, N.	13
150.	19	Abder-Rahman Ha	13
151.	19	Abou karaki, Najib	13
152.	19	Al-Bawab, A.	13
153.	19	Ali, Ali A.	13
154.	19	Al-Rawi, Z.R.	13
155.	19	Al-Talib, Mahmoud	13
156.	19	Alwinah, Ahmad D	13
157.	19	Ammari, Hani.	13
158.	19	Arafah, D.E.	13
159.	19	Bandel, Klaus	13
160.	19	Mohammad Khalifeh	13
161.	19	Rajab, L	13
162.	20	Abd Al-Hafiz, Subhi	12
163.	20	Abu Ghalyun, Yunus Y.	12
164.	20	Abu-Gazleh, S.M.	12
165.	20	Abu-Gharbieh, Walid I.	12
166.	20	Abu-Irmaileh, B.E.	12
167.	20	Abu-Zanat, M.	12
168.	20	Al-Bayari, O.M.	12
169.	20	Al-Jaber, ahmad	12
170.	20	Al-Momani, Raid	12

171.	20	Al-Nsour, Amer	12
172.	20	Al-Sharif, Sh	12
173.	20	Al-Sman, Ahmad	12
174.	20	Dawood, Zuboor Fathi	12
175.	20	Moghram, Ibrahim S.	12
176.	20	Muayyad Ahmad	12
177.	20	Muheilan, Mustafa M.	12
178.	20	Nazer, Ibrahim K.	12
179.	20	Razouki, Sabah S.	12
180.	20	Rimawe, Ahmad	12
181.	20	Saffarini, G.A.	12
182.	20	Salameh, E.	12
183.	20	Salameh, Elias	12
184.	20	Salim, F. Haddad	12
185.	20	Sarie, Talib	12
186.	20	Sawas, A.	12
187.	20	Shaheen, Omar	12
188.	20	Shahin, Issa S.	12
189.	20	Sharaf, Naim	12
190.	20	Shomaf, M.S.	12
191.	20	Tarawinah, Khaled A.	12
192.	20	Teskey, W.F.	12
193.	20	Yousuf, A.K.	12
194.	20	Zalmout, Iyad	12
195.	21	Bustami, Faraj	11
196.	21	Dababneh, M.	11
197.	21	Excel, P.S.	11
198.	21	Farhan, A.M.	11
199.	21	Fayyad, Manar	11

200.	21	Feilat, E.	11
201.	21	Fleischer, B.	11
202.	21	Gharaibeh, Munir N.	11
203.	21	Gharaibeh, S.	11
204.	21	Gharaybeh, Fouad Ahmad	11
205.	21	Ghawi, I.	11
206.	21	Haddad, Nasri I.	11
207.	21	Hadid, S.B.	11
208.	21	Halabi, Yahia	11
209.	21	Hamed, Osama Ahmad	11
210.	21	Hammad, M.	11
211.	21	Harb, Muhammad	11
212.	21	Hejazi, Z.M.	11
213.	21	Homewood, K.	11
214.	21	Hourani, Muhammad Khair	11
215.	21	Hussein, Deep	11
216.	21	Jalham, Isam S.	11
217.	21	Kamrani, A.	11
218.	21	Khalid Hameed	11
219.	21	Khoury, Hani N.	11
220.	21	Khuri, Hani	11
221.	21	Kofahi, Najib A.	11
222.	21	Lataifeh, Mahdi S.	11
223.	21	Latayifah, Mahdi	11
224.	21	Lubbadeh, W.F.	11
225.	21	Macario, R.C.	11
226.	21	Mahafizah, Muhammad	11
227.	21	Mahmud, Sabri S.	11
228.	21	Malkawi, Abd Allah I. Husein	11

229.	21	Masad,J	11
230.	22	Abdel-Fattah, M.	10
231.	22	Abdelnaser, K.	10
232.	22	Abdol-Qader	10
233.	22	Abu Safiya, A.	10
234.	22	Abu Salih, M.S.	10
235.	22	Abueladas, A.	10
236.	22	Abu-Ghazaleh, Bassam N.	10
237.	22	Ahmad, M.S.	10
238.	22	Akkawi, Mazen	10
239.	22	Al-Adhami, M.A.	10
240.	22	Al-Battah, Mohmoud M.	10
241.	22	Al-Bayati, Redha ibrahim	10
242.	22	Al-Ezeh, Hassan	10
243.	22	Al-Ghazawi, M.	10
244.	22	Al-Hadidi, M.	10
245.	22	Al-Hawary, talal Ali	10
246.	22	Al-Kharabsheh, Atef	10
247.	22	Al-Kurdi, Zaid D.	10
248.	22	Allawi, Thabet F.	10
249.	22	Al-Omari, I.A.	10
250.	22	Al-Sahhi, A.	10
251.	22	Al-zu'bi, Khaled	10
252.	22	Amireh, B.	10
253.	22	Asfar, O.	10
254.	22	Asfour, Hasan Mostafa	10
255.	22	Attallah, Moh'd	10
256.	22	Awidi, Abdalla S.	10
257.	22	Badran, M.I.	10

258.	22	Baklizi, Ayman	10
259.	22	Basma, Adnan A.	10
260.	22	Batainah, Barakat	10
261.	22	Bataineh, M.	10
262.	22	Bdour, S.	10
263.	22	Bitar, R.N. ahmad	10
264.	22	Bitar, Riyad	10
265.	22	Craig, P.	10
266.	22	Damhoureyeh, S.	10
267.	22	Disi, Ahmad M.	10
268.	22	Elayan, Hamzah	10
269.	22	El-Jaafreh, Yousef G.	10
270.	22	El-Khateeb, Muhammad	10
271.	22	Muhsin, Tawfiq	10
272.	22	Najmi, A.	10
273.	22	Nathir Al-Rawashdeh	10
274.	22	Omari, Mo	10
275.	22	Omari, Yousif I	10
276.	22	Qasem, J. R.	10
277.	22	Qrunfleh, Mostafa Moham'ed	10
278.	22	Qudah, Ali M.	10
279.	22	Qudah, Muhammad A.	10
280.	22	Roger, D. Willett	10
281.	22	Said, M.R.	10
282.	22	Sakaji, A.	10
283.	22	Saket, Munib	10
284.	22	Saleh, Ahmad Salem	10
285.	22	Saleh, Naser S.	10
286.	22	Sallomi, Issam J.	10

287.	22	Salman, A.J.	10
288.	22	Samawi, Hani	10
289.	22	Sawwam, Jamal	10
290.	22	Sayed, Salaheddin A.	10
291.	22	Saymeh, Riyadh A.	10
292.	22	Shoobaki, J.	10
293.	22	Suwwan, M.A.	10
294.	22	Sway, Muhammad Izzat	10
295.	22	Taani, Ali	10
296.	22	Tashtoush, H.	10
297.	22	Tashtoush, Suliman M.	10
298.	22	Utum, Manar	10
299.	22	Zabalawi, Isam H.	10
300.	22	Zahal, M.H.	10
301.	23	Abderrazzaq, M.H.	9
302.	23	Abu Al-Haj, Muhammad	9
303.	23	Al—Kofahi, I.	9
304.	23	Al—Matar, Ali	9
305.	23	Al-Momani, A.	9
306.	23	Al-Nasser, A.S.	9
307.	23	Al-Qaasem, H.	9
308.	23	Al-Share, M.	9
309.	23	Al-Shawabkeh, A.	9
310.	23	Al-Shrouf	9
311.	23	Al-Zoubi, A.Y.	9
312.	23	Al-Zoubi, K.	9
313.	23	Amjad Mahasneh	9
314.	23	Amr, Ayed S.	9
315.	23	Attiyat, Abdulrahman S.	9

316.	23	Ayoub, Jamil N.	9
317.	23	Azzam, Mufid M.	9
318.	23	Azzous, A.S.	9
319.	23	Closson, D.	9
320.	23	Dabbagh , Abd al-Majid M.	9
321.	23	Dahiyat, Eid A.	9
322.	23	Dajeh, D.	9
323.	23	Dalabeih, D.M.	9
324.	23	Daradkeh, Tewfik K.	9
325.	23	Darwish, Hatim	9
326.	23	Dwairi, M.	9
327.	23	El-Ali, A.	9
328.	23	El-Khatttari, Sayed	9
329.	23	El-Shanti H	9
330.	23	Esmadi, F.T.	9
331.	23	Esmadi, Fatima T.	9
332.	23	Fatafitah, Zakariyya	9
333.	23	Fayez Daoud	9
334.	23	Feras Alali	9
335.	23	Fora, Ali Ahmad	9
336.	23	Gillin, W.P.	9
337.	23	Habali, S.M.	9
338.	23	Hailat, Muhammad Q.	9
339.	23	Haimour, Noman M.	9
340.	23	Hajja, Mowaffaq	9
341.	23	Hammoudeh, A.	9
342.	23	Henk, T.	9
343.	23	Hijjawi, R.	9
344.	23	Hilow, H.	9

345.	23	Hulings, Neil C.	9
346.	23	Humeid, M.A.	9
347.	23	Humeid, Muhammad Ali	9
348.	23	Huniti, D.	9
349.	23	Husband, Ahmad	9
350.	23	Ibrahim Mansour	9
351.	23	Idrees Al-Momani	9
352.	23	Jaradat, Sa'id	9
353.	23	Jawad, Ali, A.	9
354.	23	Judah, O.M.	9
355.	23	Kedher, M.	9
356.	23	Khalaif, H.	9
357.	23	Khalaif, Hamed	9
358.	23	Khalifeh, J.M.	9
359.	23	Khalil, Rabah A.	9
360.	23	Khanfar, Muhammad I.	9
361.	23	Khateeb, A.M.	9
362.	23	Mahasneh, Adel M.	9
363.	23	Majali, S.	9
364.	23	Malkawi, H.I.	9
365.	23	Manar Khalid Fayyad	9
366.	23	Mansour, A.N.	9
367.	23	Masoud,Samey	9
368.	23	Meric, E.	9
369.	23	Mohammad Al-Natour	9
370.	23	Mohammad Hasan	9
371.	23	Mohammad Mulqi	9
372.	23	Mubarak, M.S.	9
373.	23	Muhammad, Z.	9

374.	23	Mumani, Kamal A.	9
375.	23	Muttlak, H.	9
376.	23	Nader, Amer D.	9
377.	23	Natour, Rashad	9
378.	23	Nour, T.M.	9
379.	23	Odeh, Sameh	9
380.	23	Qadi, Isma'il	9
381.	23	Qaqish, Smih	9
382.	23	Qasim, Wajih	9
383.	23	Rida Shibli	9
384.	23	Roshdi Khalil	9
385.	23	S. Daradkeh	9
386.	23	Saad Abo-Qudais	9
387.	23	Sabri, Salims	9
388.	23	Saeed, M.S.	9
389.	23	Saffarini, Ghazi	9
390.	23	Said, M.R. Hamam	9
391.	23	Salah, Mundhir M.	9
392.	23	Saleh Sadiq and Lahham, J.	9
393.	23	Saleh, M.	9
394.	23	Salem, Mutaz Shiekh	9
395.	23	Salhab, A.S.	9
396.	23	Salih, Muhammad	9
397.	23	Sallomi, Isaam J.	9
398.	23	Samawi, H.M.	9
399.	23	Sengupta, S.	9
400.	23	Sharaiha, Ramzi Khalil	9
401.	23	Shatat, F.	9
402.	23	Shatat, Fahmi	9

403.	23	Shawagfeh, N.T.	9
404.	23	Siren Shibayeh	9
405.	23	Steitieh, Akram M.	9
406.	23	Sulaiman, Sadallah Tawfiq	9
407.	23	Taha, M.	9
408.	23	Tantawi, Hasan M.	9
409.	23	Taylor, J.C.	9
410.	23	Thalji, Tala	9
411.	23	Thanoon , B . Y.	9
412.	23	Tripathi, T.P.	9
413.	23	Tyfour, Wail R.	9
414.	23	Umari, Husayn	9
415.	23	Vittuari, L.	9
416.	23	Voelter, Wolfgang	9
417.	23	Waddah Abdullah	9
418.	23	Warner, M.	9
419.	23	Yaghmour , Fakhry H.	9
420.	23	Younes, A.A.	9
421.	23	Zihlif, A.M.	9

Table 6.7 (A) only gives a ranked list of most productive authors irrespective of their subjects. A further investigation bringing out most productive authors in various subjects of studies in S&T universities in Jordan, is given in table – 6.7(B). The table arranges the subjects in alphabetical order and lists only three most productive authors under each subject.

The table would thus reveal the most active researchers / scientists in various fields of studies in S&T in the Universities of Jordan.

Table-6.7 (B): Subject-wise productivity of Authors

S.No.	Subject	Production Name	No. of Items
1.	Agriculture	Jamal R. Qasem	36
		Alshwabkeh, K.	31
		Sharaf, Naim S.	30
2.	Biology	Abdel-Hafez, S.K.	29
		Malkawi, Hanan I.	29
		Saadoun, I.	19
		Khalid, A.M.	18
3	Chemistry	Sadiq, May F.	30
		Abu-Orabi, Sultan T.	29
		Marji, Dhib	26
4.	Computers	Al-Fahoum, A.	22
		Abu-Dayyed Walid	20
		Al-Agtash, S.	20
		Al-Fayiymi, N.	16
5.	Dentistry	Abu-Hammad, Oa	29
		Harrison, A.	14
		Rajab, L.	13
6.	Earth Science	Abed Aldulkader, M.	31
		Jarrar, Ghaleb H.	30
		Abu-Jaber, N.	29
7.	Electronics	Abo-Zahhad, Muhammad	31
		Al-Bayari, O.	30
		Al-Hanbali, N.N.	28
8.	Engineering	Abou Karaki, Najib	29
		Hamdan, M.A.	28
		Jerrik, A.J.	28
		Duwayri, Mahmud	27

9.	Mathematics	Hajja, M.	31
		Younis, M.S.	31
		Abumurad, K.M.	30
		Awad, Adnan M.	30
		Altee, Majid	29
10.	Medical Sciences	Amro, B.I.	28
		Battah, Ah.	25
		Yamin, H.Y.	25
		Majeed, H.A.	18
11.	Microbiology	Horani, Hala	30
		Asem A. Shehabi	29
		Al-Qaoud, K.	22
12.	Nursing	Muayyad, Ahmad	12
		Kamrani, A.	11
		Arwa, Owais	6
13.	Pharmacy and Pharmacology	Aburjai, T.	29
		Hadidi, K.H.	27
		Al-Ruzouq, R.	25
14.	Physics	Mustafa, H.	33
		Mahmood, Sami	31
		Al-Bataina, Barakat A.	27

6.7 (C) Single Vs Multiple Authorship Pattern

Pattern of Authorship may also be studied as given in Table 6.7 (C). Modern day's research is characterized by collaborative efforts on the part of scientists and scholars. However, authorship of publications of Jordanian scholars presents a different pattern, as given in the following paragraphs.

Table 6.7 (C) shows 48.43% of the total published output in single authorship. This is followed by two and three authorship patterns constituting 30.89% and 15.45% respectively. Beyond that the percentage of authorship is too far less because six and seven authorship pattern shows 0.2% and 0.09% respectively.

The peculiar behaviour of Jordanian scholars with regard to the authorship is probably because of the fact that they prefer to work mostly independently in their laboratories. When it comes to collaboration in research, their first preference is two collaborators constituting 30.89% followed by 3 authors making 15.45% of the total.

Table 6.7 (C): Single Vs Multiple Authorship Pattern

S.No.	Rank	Authorship Pattern	Frequency	%
1.	1	Single	3081	48.43
2.	2	Two	1965	30.89
3.	3	Three	983	15.45
4	4	Four	224	3.52
5	5	Five	88	1.38
6	6	Six	13	0.20
7	7	Seven	6	0.09
8	8	Eight	1	0.02
	Total		**6361**	**99.98**

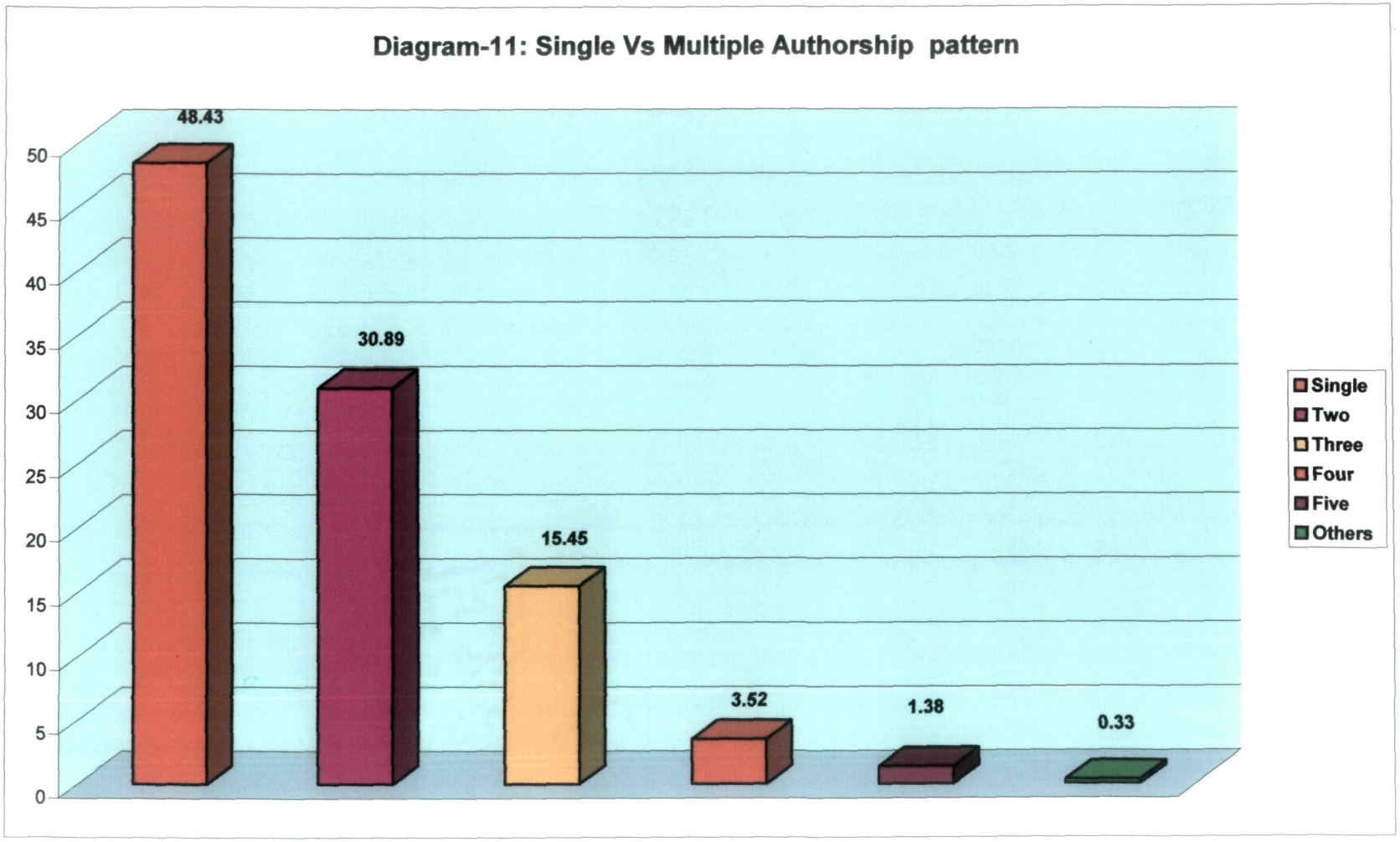


Diagram-11: Single Vs Multiple Authorship pattern
48.43
30.89
15.45
3.52
1.38
0.33
50
45
40
35
30
25
20
15
10
5
0
Single
Two
Three
Four
Five
Others

Table 6.7 (D) Year-wise contribution of authors

Contribution of authors may also be studied with a still different angle as shown in table 6.7(D), wherein year wise contribution along with authorship pattern has been shown.

This table studies year wise contribution of Faculty members of Jordanian universities in Science and Technology. In 1995, the table shows 129, 153 and 75 contributions by 1, 2 and 3 authors respectively. The year 2000 showed 270 publications by single authors; 225 by two authors; and 88 by three authors. During 1995 to 2005, the number of single authors' contributions increased from 129 to 412, followed by two and three authors' contributions from 153 to 229 and 75 to 104 respectively.

The above table gives general observation about the steady growth of S&T publications from a total of 384 items (6.03%) in 1995 to 612 items (9.62%) in 2000 and 789 items (12.40%) in 2005.

Authorship pattern may also be studied in relation to year wise contribution. In 1995 joint contribution by two author appeared to be the highest i.e. 39.84%. This pattern somehow slowly changed and single authorship seemed to be dominating consistently as we find 44.12% of such contribution in the year 2000 and 52.21% in the year 2005.

The table provides a general view that Jordanian scholars in S&T universities always preferred to write mostly as single authors followed by two author's contribution. Contributions with three, four and five authors have always been their last choice. As evident from table 6.7(D), contribution by three authors never increased beyond 20%; and that with four and five authors not beyond 5% and 2% respectively.

It simply shows that the preference of Jordanian scholars has always been single authorship followed by two and three authorship pattern during the period of study. The apparent reason being the criteria of promotion from lower to higher cadre, as 100% weightage are

given to single author's contribution. In case of more than three authors, the weightage is divided among all the contributors.

Table 6.7 (D): Year-wise and Contributions of Authors (1995-2005)

S.No.	Authors	Single	Two	Three	Four	Five	Six	Seven	Eight	Total	%age
1.	1995	129	153	75	18	5	2	2	-	384	6.03
		33.55	39.84	19.53	4.69	1.30	0.52	0.52		99.99	
2.	1996	161	146	83	21	6	1	-	-	418	6.57
3.	1997	194	176	65	19	6	-	-	-	460	7.23
4.	1998	177	184	89	15	7	-	-	-	472	7.42
5.	1999	265	152	77	11	9	1	-	-	515	8.09
6.	2000	270	225	88	20	8	1	-	-	612	9.62
		44.12	36.76	14.38	3.27	1.31	0.16			99.45	
7.	2001	312	176	97	30	8	2	-	1	626	9.84
8.	2002	364	139	102	20	9	-	-	-	634	9.96
9.	2003	409	178	98	21	8	6	3	-	723	11.36
10.	2004	388	207	105	17	10	-	1	-	728	11.44
11.	2005	412	229	104	32	12	-	-	-	789	12.40
		52.21	29.02	13.18	4.06	1.52				99.97	
	Total	**3081**	**1965**	**983**	**224**	**88**	**13**	**6**	**1**	**6361**	**99.96**
	%	**48.43**	**30.89**	**15.45**	**3.52**	**1.38**	**0.20**	**0.09**	**0.02**	**99.98**	

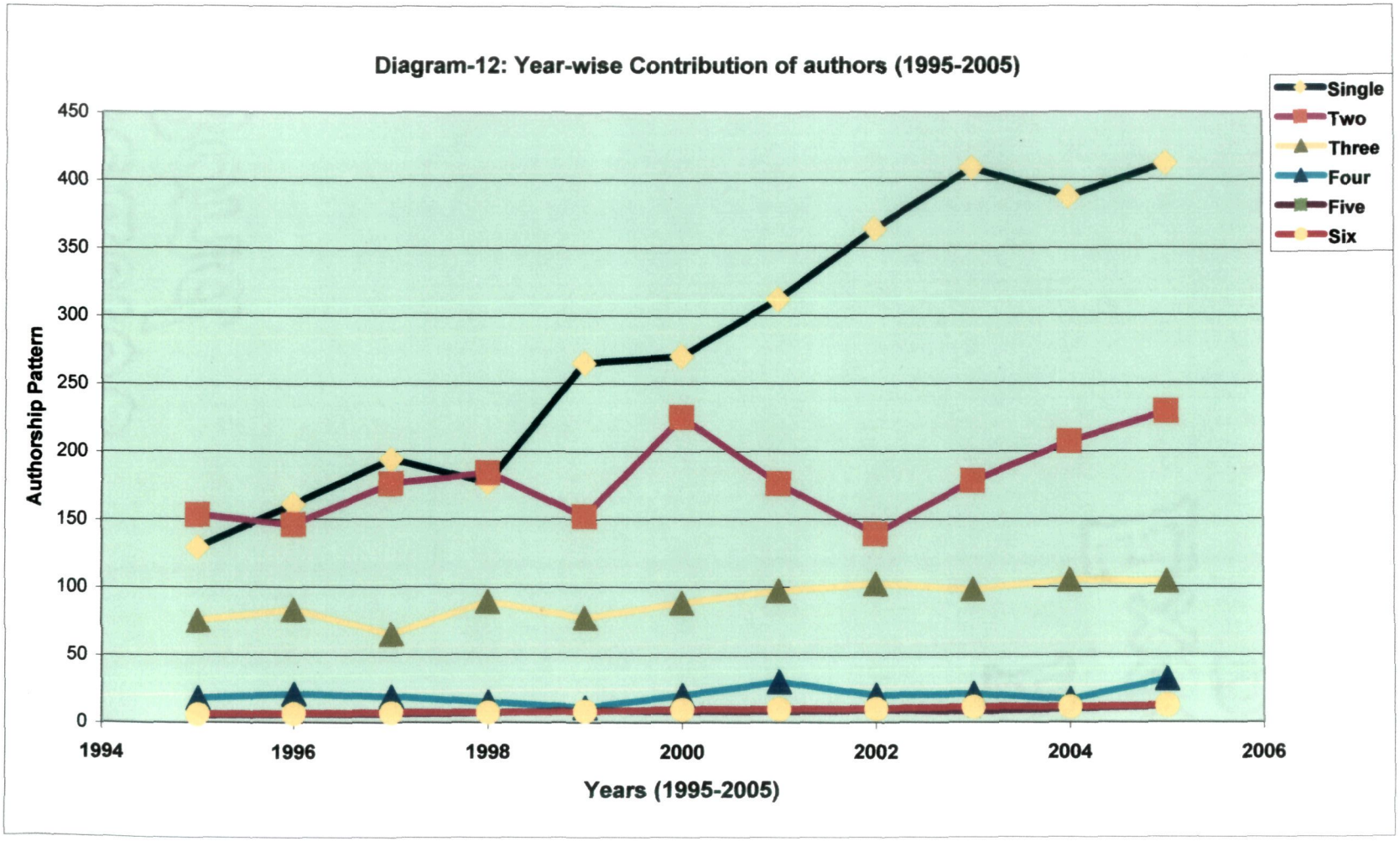


Diagram-12: Year-wise Contribution of authors (1995-2005)
Authorship Pattern
450
400
350
300
250
200
150
100
50
0
1994
1996
1998
2000
2002
2004
2006
Years (1995-2005)
Single
Two
Three
Four
Five
Six

Table 6.7(E) studies the gender wise distribution of authors. The table reveals that 88.41% of contributions are made by male faculty members. While the female faculty members contributed only 4.45%. The joint contribution of males and females faculty members is also not very encouraging, as only 7.14% of the total publications were contributed by both. The apparent reason for this type of distinction is the ratio between male and female faculty members in Jordanian universities.

Table – 6.7 (E) Gender-wise Distributions

S.No	Author Gender	No. of items	Percentage
1	Male	5624	88.41
2	Male & Female	454	7.14
3	Female	283	4.45
	Total	**6361**	**100**

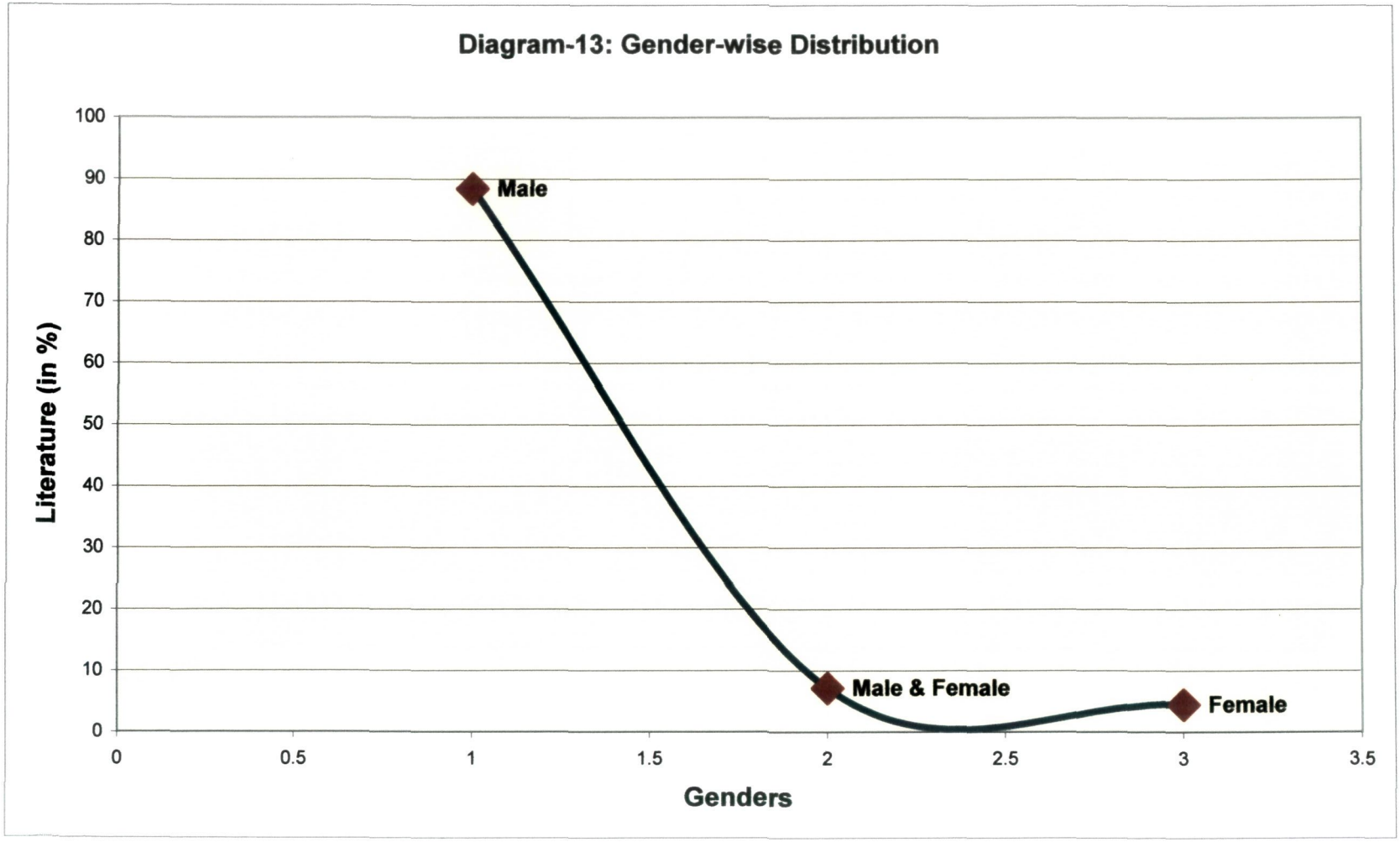


Diagram-13: Gender-wise Distribution
Literature (in %)
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
3.5
Genders
Male
Male & Female
Female

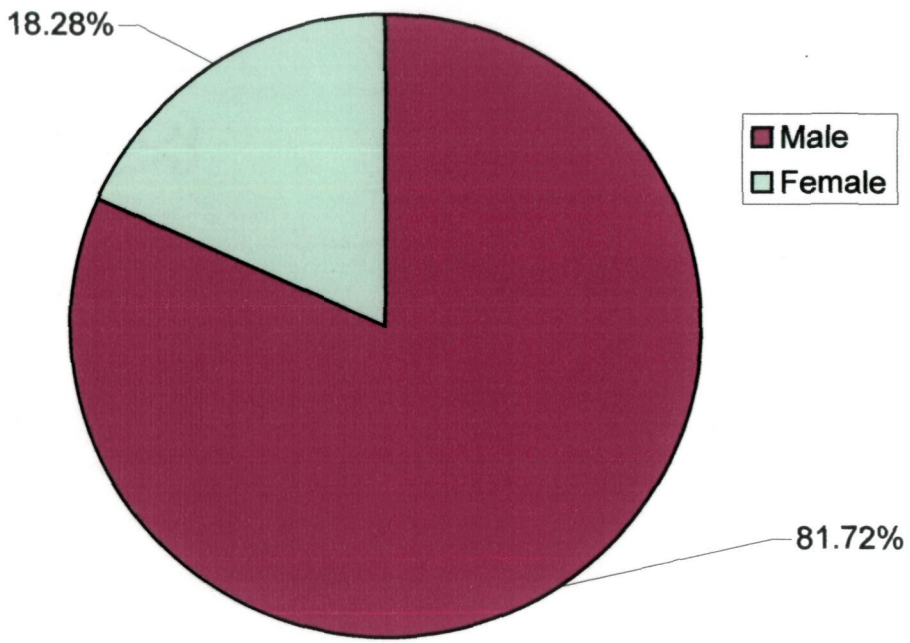
Table 6.7 (F) Academic Staff in The Jordanian Universities By Academic Rank On The Year 2005/2006

S. No.	ACADEMIC RANK/University		Total	Full Prof.	Associate Prof.	Assistant Prof.	Instructor	Lecturer	Res. Ass.
		T	6542	1001	1172	2572	810	494	493
		F	1196	48	93	371	303	161	220
1	The University of Jordan	T	1129	331	222	352	54	91	79
		F	220	16	27	73	34	35	35
2	Yarmouk University	T	770	206	176	205	116	0	67
		F	109	11	8	18	42	0	30
3	Mu'tah University	T	538	106	149	152	22	96	13
		F	54	4	4	11	5	25	5
4	Jordan Uni. Of Science & Technology	T	688	97	153	282	3	138	15
		F	111	1	10	45	0	49	6
5	The Hashemite University	T	445	38	45	200	24	50	88
		F	104	1	6	35	13	8	41
6	AL al – Bayt University	T	229	17	19	138	55	0	0
		F	33	0	2	10	21	0	0
7	Al-Balqa' Applied University	T	302	22	29	113	51	14	73
		F	36	0	2	4	3	2	25
8	Al-Hussain Bin Talal University	T	118	6	15	67	9	15	6
		F	10	0	0	6	1	1	2
9	Tafila Technical University	T	118	3	14	40	20	20	21
		F	8	0	0	1	6	0	1
10	German Jordanian University	T	18	3	2	5	0	8	0
		F	9	0	0	1	0	8	0
11	Al – Ahliyya Amman University	T	296	23	49	110	58	5	51
		F	74	0	7	7	23	1	36
12	Applied Science Uni. (Private)	F	65	3	2	33	11	16	0
		T	368	22	59	127	81	1	78
13	Philadelphia University	T	368	22	59	127	81	1	78
		F	95	3	5	14	33	1	39
14	Al – Isra Private University	T	256	28	35	115	78	0	0
		F	49	2	2	21	24	0	0
15	University of Petra	T	186	18	33	76	59	0	0
		F	72	2	5	24	41	0	0

16	Al-Zaytoonah Private Uni. Of Jordan	T	267	30	62	117	30	28	0
		F	77	5	12	36	9	15	0
17	Zarqa Private University	T	149	8	18	90	33	0	0
		F	17	0	0	8	9	0	0
18	Irbid National University	T	121	2	16	78	25	0	0
		F	17	0	1	5	11	0	0
19	Jerash Private University	T	162	7	15	97	43	0	0
		F	21	0	0	10	11	0	0
20	Princess Sumaya Uni. For Tech.	T	41	7	7	19	8	0	0
		F	3	0	0	2	1	0	0
21	Jordan Academy of Music	T	13	0	2	3	4	2	2
		F	4	0	0	0	4	0	0
22	Educational Sciences Faculty	T	24	0	2	19	2	1	0
		F	8	0	0	7	1	0	0

As per the data (Table 7-F) available from the 'Ministry of Higher Education' of Jordan given, it may be noted that 81.72% faculty members are males while 18.28% are females. Hence the contribution of the faculty members of both the genders is in the same proportion. (Table 7-E).

Diagram-14: Academic Staff in the Jordanian University (2005-2006)



Reference

1. Prylherch, Ray (2005) "Harrod's Librarians' Glossary : and Reference book, London, Ashgate.
2. Prasher, R.G. (2003) "Information and its Communication" Ludhiana, Medalion Press.

Chapter Seven

Application of Bibliometric Laws

CHAPTER SEVEN

APPLICATION OF BIBLIOMETRIC LAWS

Having analyzed the data to conduct scientometric study on 'Publications in Science and Technology by Faculty Members in Universities of Jordan" it is worthwhile to apply the same data to check the validity of bibliometric laws like 'Bradford's law of scattering; Lotka's inverse square law; Zipf's law of word occurrence'.

7.1 Bradford's law of Scattering:

This law states that if scientific periodicals are arranged in order of decreasing productivity of articles on a given subject that may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and succeeding zones will be given as:

1: n: n2

Where '1' is the number of periodicals in the nucleus and 'n' is a multiplier.

To check the validity of this law, 524 periodicals were divided into three zones according to their productivity. 10 journals contained 2126 items in the first zone, 77 journals contained 1614 items in the second zone and remaining 437 journals contained 2140 items in the third zone. According to this, the periodicals in each zone covered approximately 1/3 items of the total. This analysis shows, phenomenon of scattering of items in different zones of journals.

For all this, data has been taken from table 1(a) and table 1(b) 'Ranking of periodicals' and 'Range of frequency' respectively.

This first zone is the nucleus as it contains 10 periodicals, followed by 77 periodicals in the second zones and 437 periodicals in

the third zone. The zones, thus identified will form an approximately geometric series as given below:

10:77: 437

Here $77 \cong 70$ = 10 x 7 (Approx.)

$437 \cong 490$ = 10x7x7(Approx.)

Therefore, now the series is

10:10 x 7: 10 x 7 x 7

On substituting 7 = n

We get 10: 7 n: $7n^2$

i.e. 1: n: n^2

i.e. 1: n: n2 (Where '1' is the number of periodicals in the nucleus and 'n' is a multiplier)

The Bradford law is proved thus.

Table 7.1 Bradford's Law

S. No	No. of Journal	Cumulation of Journals	No. of Items	Cumulation of Items
1	1	1	406	406
2	1	2	391	797
3	1	3	371	1168
4	1	4	266	1434
5	1	5	210	1644
6	1	6	197	1841
7	1	7	186	2027
8	3	10	99	2126
	10		2126	
9	9	19	270	2396
10	3	22	87	2883
11	9	31	243	2726
12	5	36	120	2846

13	10	46	200	3046
14	8	54	144	3190
15	22	76	374	3564
16	11	87	176	3740
	77		1614	
17	18	105	252	3992
18	19	124	247	4239
19	12	136	132	4371
20	32	168	320	4691
21	19	187	152	4843
22	4	191	28	4871
23	44	235	264	5135
24	28	263	140	5275
25	42	305	168	5443
26	66	371	198	5641
27	86	457	172	5813
28	67	524	67	5880
	437		2140	

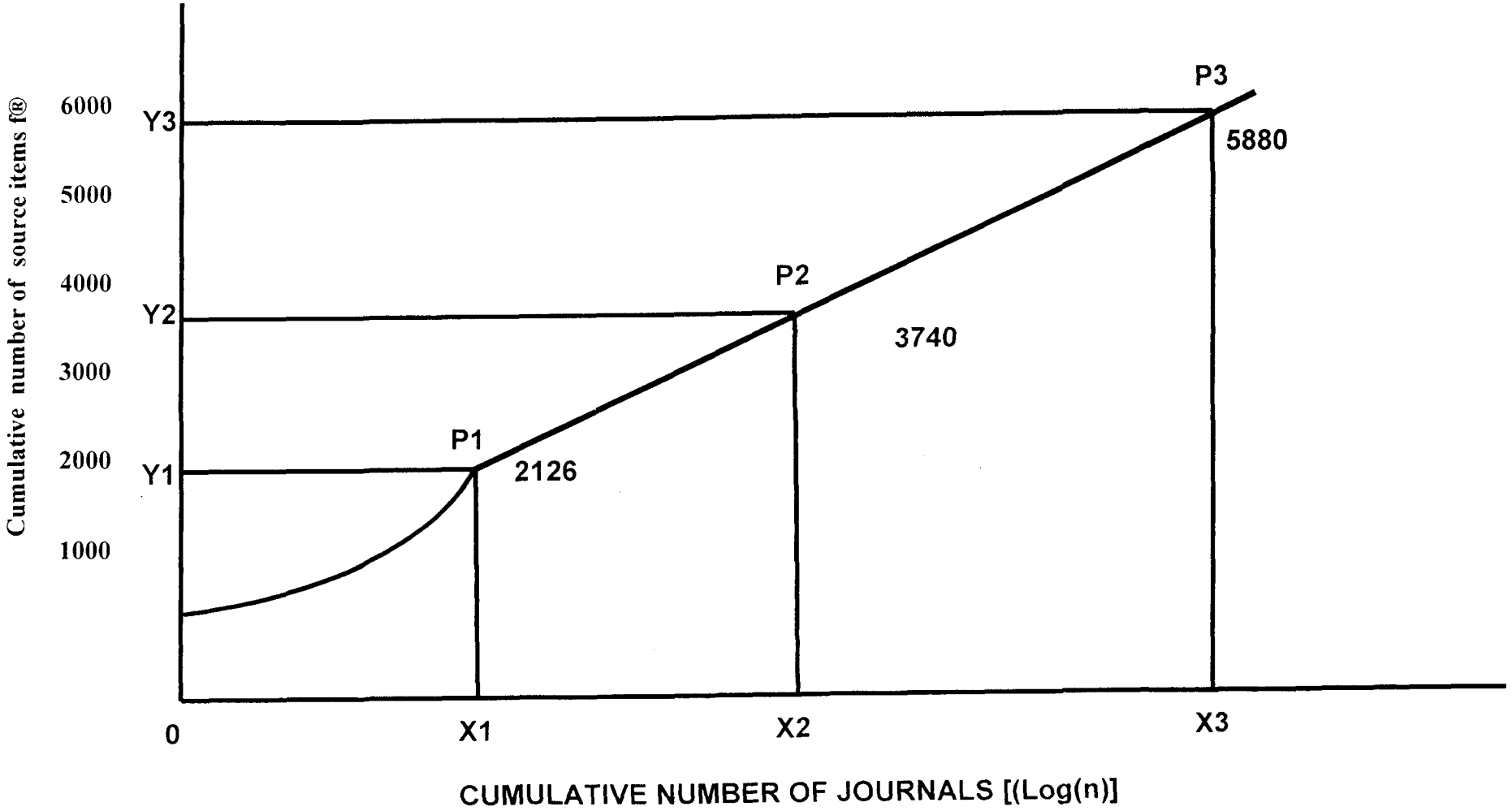
The number of journals in the nucleus can be obtained by plotting f(r) and log n on semi logarithmic graph paper (a bibliograph), where f(r) is cumulative frequency and log 'n' is log of rank of journals as shown in the graph. This graph is drawn with the help of data analyzed and computed in table 7.1

The log value of 10 journals in the first zone is 1 the log value of 77 journals in the second zone is 1.886 and the log value of 437 a journal in the third zone is 2.640.

Taking log 'n' on X-axis and number of items in each zone on Y-axis a graph was plotted as shown. The bibliograph thus obtained, is found to be, by and large, similar to Bradford's bibliograph. As the

graph begins as a rising cure AP_1 and continues as a straight line. The rising part of the graph represents the nucleus of highly productive journals. The point P1, P2 and P3 on the bibliograph are the boundaries of three equi-productive zones in which almost the same number of articles as the nucleus (represented by $0Y_1 = Y_1\ Y_2 = Y_2\ Y_3$) derived from an increasingly large number of journals (represented by $0X_1$, $X_1\ X_2$ and X_2X_3). The Bradford's Law is proved thus.

DIAGRAM-15: BRADFORD'S BIBLIOGRAPH



7.2 LOTKA'S INVERSE SQUARE LAW

Alfred, J. Lotka, in the year 1926 proposed his inverse square law, correlating contribution of scientists to their number that has been, explained earlier in chapter-5. According to this law "number of scientists who contribute 'n' paper will be $1/n^2$ of those who contributed only 1 paper".

In the present study, it was observed that a total number of 3593 Authors, have contributed 6361 items, of which, only 2103 Authors contributed more than one paper and the rest 1490 have contributed only one paper each.

Lotka's law was applied to know the number of authors contributing 2, 3, and 4 papers respectively as given in table 7.2.

7.2.1 AUTHORS CONRIBUTING 2 PAPERS

As we know that the number of authors contributing only 1 paper is 1490. Therefore number of authors contributing only 2 papers may be calculated by the formula.

No. of authors publishing n paper = $\frac{No.of\ authors\ producing 1\ paper}{n^2}$

On substituting, n = 2 in the above formula.

No. of authors publishing 2 papers = $\frac{1490}{2^2} = \frac{1490}{4} = 372$

It means the number of authors publishing 2 papers should be 372 However; an analysis of the data indicates that only 518 authors have contributed 2 papers which are far less than the figure, obtained by applying the law.

7.2.2 AUTHORS CONTRIBUTING 3 PAPERS

On substituting, n = 3 in the above formula

No. of authors publishing 3 papers $\frac{1490}{3^2} = \frac{1490}{9} = 165$

But the present analysis shows that only 165 Authors have contributed 3 papers, which is far less than the figure i.e. 216.

7.2.3 AUTHORS CONTRIBUTING 4 PAPERS

On putting n = 4 in the formula

No. of authors publishing 4 papers ' $\frac{1490}{4^2} = \frac{1490}{16} = 93$

The present analysis shows that only 330 authors contributed 4 papers which are again far less than the calculated figure i.e. 330 as shown below-

TABLE 7.2 LOTKA'S LAW

No. of contribution	No. of authors by applying Lotka's Law	Actual No. of authors
2	372	518
3	165	216
4	93	330

It may therefore be concluded that the trend of research now days, have changed as compared to the period when Lotka's law was formulated. That is why it is difficult to satisfy the Lotka's law, on the basis of the analysis of the present data.

7.3 Zipf's law of word occurrence

This law states that in a long textural matter, if words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be universally proportional to the frequency of occurrence of the word

i.e. $r \alpha 1/f$ (where 'r' is rank and 'f' is frequency)

$\therefore$ $r = c/f$ (where c is a constant)

Taking log on both the sides

$$Log(r) = log(c) - log(f)$$

Or

$$log(f) + log(r) = c' \qquad \text{(where c is constant)}$$

To apply this law, the words (Terms) were collected from the title of the articles and ranked according to their frequency of occurrence in the decreasing order. Only those words occurring up to 25 times are given in the table7.3

On the application of this law, it is found that log of frequency of occurrence of words when added to log of their rank, the results are almost same for each word.

Word : Science

Frequency : 667 items

Rank : 1

Log of frequency + log of rank

Log 667 +log1 = 2.830 + 0= 2.830

Word : Research

Frequency : 526 items

Rank : 2

Log of frequency + log of rank

Log 526 + log2 = 2.720 + 0.3010 = 3.0210

Word : Technology

Frequency : 362 items

Rank : 3

Log of frequency + log of rank

Log 362 + log3 = 2.558 + 0.477 = 3.035

Looking at the figures i.e. 2.830, 3.0210 and 3.035, we find the values for the three selected words as constant.

Thus, the validity of Zipf's law is satisfied on the present data.

TABLE. 7.3

Ranking of Word Occurrence

S.No.	Rank	Words	Freq.	Log (c)
1	1	Science	667	2.830
2	2	Research	526	2.720
3	3	Technology	362	2.558
4	4	Scientific	257	2.409
5	5	Literature	145	2.161
6	6	Publication	117	2.068
7	7	Knowledge	81	1.908
8	8	Chemistry	65	1.812
9	9	Physics	51	1.707
10	10	Mathematic	49	1.690
11	11	Engineering	48	1.681
12	12	Medical	46	1.662
13	13	Computer	37	1.568
14	14	Architecture	36	1.556
15	15	Biology	33	1.518
16	16	Nursing	29	1.462
17	17	Electronic	27	1.431
18	18	Agriculture	25	1.397

Chapter Eight

Major Findings, Conclusion & Recommendations

CHAPTER- EIGHT

MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

8.1 INTRODUCTION

Science and Technology are generally recognized as important strategic factors determining the future development and welfare of nations. The terms 'knowledge society' and 'knowledge based economy' have been recently coined in order to bring into relief the crucial role of scientific knowledge in economic and social development of Nations. Developed countries, therefore, invest heavily in Science and Technology research and development programmes resulting into a sizable bulk of literature produced by the scientists and researchers of those countries. Collaboration at national and international level is suggesting ways of building Science and Technology capacity in developing countries also.

Jordan's concern with Science and Technology dates back to an early stage in the evolution of Jordanian state in 1921. Continued economic and social transformation and activating the investment of manpower and national resources available in Jordan, accelerated the efforts to institutionalize the national ambitions in Science and Technology field. The establishment of higher council for Science and Technology in the year 1987 confirmed the desire of the Jordanian state in making Jordan a center of excellence in many fields. Jordan has adequate infrastructure for the development of Science and Technology specially within the universities and centers of scientific research. As far as research activities in the universities are concerned, the faculty

members' contribution is quite significant. At the moment Jordan has as many as 10 universities maintained by the Government of Jordan. In addition to that, there are 12 private universities, which also contribute to the development of Science and Technology.

Scientometric analysis of Science and Technology publications by the faculty of Jordanian universities provided dependable methods of measuring scientific activity in terms of the output of scientific publication. The study was aimed at identifying and describing some of the characteristics of the literature published in the field of Science and Technology by the Faculty members of Jordanian Universities over a period of 11 years (1995-2005) with a view to identify most productive author, core journals, place, time, subject, country of origin of publications.

To undertake scientometric study on the scientific literature of faculty members of Jordanian universities of Science and Technology, "a number of sources as given in chapter-6 were consulted.

A database was developed using Oracle8i package as detailed in chapter 1. The data was collected, tabulated and analysed in order to conduct the following studies:-

8.2 FINDINGS

8.2.1 Ranking of Periodicals:

Periodicals are regarded as one of the most important primary source of information specially in Science and Technology because they contain the findings of original research. The aim of this study was to identify the core journals wherein most of the articles have been contributed by the faculty members of Jordanian Universities in the field of Science and Technology. The result of this type of study will be

useful from the point of view of faculty members as they will come to know about the core journals in their own field, as also by the librarians who may utilize this information in the preparation of the subscription list of periodicals, whether in print or electronic form.

The collected data included 5880 references published in 524 journals. The analysis shows that the most of the faculty members preferred to get their scientific contributions published in the periodicals issued from Jordan itself. The top 7 journals belong to the subjects namely Agriculture, Engineering, Medicine, Biology, and Pure Science. However, the journal titled 'Dirasat' published from the University of Jordan occupied number one position. The journal Dirasat in fact publishes articles into 5 main branches of Science and Technology in Arabic as well as in English. Another reason of its popularity may be attributed to its feature that the abstract of the articles are published in both the languages in respect of the fact whether the article is in English or in Arabic. The other 6 journals occupying successive ranks are Mu'tah, Journal for Research and Studies, Abhath Al-Yarmouk, Dirasat, Agricultural Science, Dirasat, Engineering Science, Dirasat, Medical and Biological Sciences and Dirasat, Pure science and Engineering respectively.

The faculty members of Jordanian universities also like to publish in foreign journals from USA, Germany and Australia but contributions in each of them is less than 1%.

The study also showed (Table 6.1 (A) that most of the literature constituting 19.86% of the total have been published by the faculty members only in 3 journals namely

1. Dirasat, Pure science
2. Mu'tah, Journal for Research and Studies,

3. Abhath Al-Yarmouk,

The next four journals contributed 14.60% of the total it means the cumulative total percentage of literature published in top 7 periodicals is 34.46%. The remaining literature was published in as many as 261 journals. In terms of Bradford's Law of Scattering the seven journals constituted core journals and for finding almost an equal number of articles one has to consult as many as 254 journals.

8.2.2 Country-wise contribution

The value of the publication is some times is judged by its place, The place of publication is used in many different ways like an individualizing element in case of Institution Conferences or as a part of imprint in descriptive cataloguing or in cataloguing of serials publications. The research output of a given country in a given subject is sometimes more as compared to others.

Again this information is useful for researchers as well as information scientists. The former always looks for the leading periodicals in their own specialized subjects for the purpose of and also for the publication of their own research. They are also interested to know the leading research laboratories / Institutes / University departments where the current research is being conducted in their own respective fields. The librarians / information scientist may this information for preparing the subscription list of the periodicals for the benefit of their clientele.

The study not only shows the leading countries bringing out the scientific outlook of Jordanian scholars but also shows their interest in publishing in widely distributed periodicals from as many as 51 countries. It was found out that about 35.74% contribution has been published in Jordanian periodicals. Second and third places are

occupied by USA and UK respectively. The preference of the Jordanian scholars for publishing in Jordanian periodicals is probably due the fact that they prefer to publish both in English as well as in Arabic.

8.2.3 Subject-wise distribution

The Bradford's Law of Scattering identifies the core journals in a given subject as also in the related journals where number is increasing proportionately for the same number of articles as in the core periodicals.

It is therefore, important to find out the subject areas of the periodicals wherein the faculty members of Jordanian Universities in Science and Technology have been published. **"Ulrich International Periodicals' Directory"** (2004) has been used to ascertain the subject fields of the periodicals.

The study shows (Table 6.3) that the faculty members of Jordanian Universities publish their scientific literature in as many as 25 subject areas. Most of the contribution amounting to 13.58% of the total was found to be in the field of Science and Technology. This was followed by Engineering with 10.58%, Mathematics with 9.91% and Medical Sciences with 9.60%.

The findings indicate that the Jordanian faculty members are more interested in the subjects of general nature like Science and Technology. They seem to be less interested in the recently developed subjects like Plastic and Ceramic etc. The reason seems to be that the facilities of studies in the subjects of general nature have been developed in the departments of studies long back whereas those in newly developed subjects are yet to be fully developed.

8.2.4 Language-wise Distribution:

The language of documents plays an important role in Scientific communication. It as only natural that the researchers / scientists know the language in which they prefer to publish and are also aware of the sources of information from where to get latest information for their own research purposes. However, there is always a possibility of existence of various other sources containing information on their interest but in other languages, not known to a given researcher. It is therefore, important to know the languages in which the information in their area of specialization is published, so that, they may keep track with the information relevant to them. The study is aimed at ranking of languages in which the published information will be helpful for the researcher/scientist in a given field.

The analysis showed (Table 6.4 (A) that English is the most preferred language of scientific communication amongst the faculty members of Jordanian Universities because 93.36% of the total items were published in English. Arabic as only the second language of preference for scholarly communication was found to constitute only 4.76% of the total contribution.

The above finding seems to be quite interesting because although the native language of Jordan is Arabic but the Scientists working in Jordanian universities are well versed in English language. It is probably because of the fact that English language has worldwide acceptability. Moreover scientific literature having its great research value is published mostly in English language journals. Another reason may be that the Jordanian faculty members like any other scholar any where in the world, want to have an international recognition as far as their publications are concerned. The study also shows that the contribution

of Jordanian faculty members appeared in 468 periodicals constituting 89.31% of the total (524 periodicals) which are published in English language only. Second place is occupied by the journals published in English and Arabic both, but they constitute only 5.15%. Even in the journals that publish both in English as well as Arabic, the contributions of the faculty members in English language is far more as compared to those in Arabic language, as shown below:

Name of Periodicals	Items published in	
	English	Arabic
1. Dirasat: Pure sciences	355	51
2. Mu'tah, Journal for Research and Studies,	336	55
3. Abhath Al-Yarmouk,	334	37

8.2.5 Year-wise distribution

Currency of information is of paramount importance in periodical publications. It is therefore, important to know the period in which the faculty members of Jordanian universities have conducted most of the researches.

The study (Table 6.5) revealed a steady growth in the production of literature by Jordanian scientists under the purview. It was found that their total contribution in 1995 was 384 items where as in 2005 it increased to 789 items (i.e. from 6.03% to 12.40%), thus showing a doubling of published output. This type of growth may be attributed to a number of factors such as (i) increase in the number of universities (i.e. from 5 in 1995 to 10 in 2005); (ii) policies of the government; (iii) personal interest of faculty members to achieve international recognition.

8.2.6 Form-wise Distribution

The format in which information is published is also important in scientific communication. The well-known formats used for the purpose are books, periodicals, conference proceedings, patents, newsletters, bulletins, research report, etc. The objective of this study is to find out the preferred formats in which faculty members of Jordanian universities like to publish.

It was noted (Table 6.6) that the periodical articles are the most popular form of scientific contribution amongst Jordanian faculty members as 92.43% of the total items are published as articles in scientific journals. The next preference is that of 'conference proceedings' constituting only 6.64% of the total items published. The books with a meager 0.91% occupy the third place only.

The reason seems to be obvious because faculty members of Jordanian universities prefer to write both an English as well in Arabic in their core journals that published in both the languages. As far as their second preference of publishing in conference proceedings is concerned, most of the conferences in Science and Technology at International level are organized in Europe and America where the language of presentation is mostly in English. Hence, 'Conference Proceedings' amount to 6.64% only. The readership of books in Arabic specially in Science and Technology is quite limited in Jordan. Hence the third preference of scholars.

8.2.7 Ranking of Authors

In every subject there are some well-known authors who have made their name by doing class scientific research. This study relates to the

ranking of faculty members of Jordanian universities on the basis of their contributions during the period of study (1995-2005).

The study (Table 6.7-A) shows that the first rank is occupied by Jamal R. Qasem (Department of Agriculture, University of Jordan) with 36 items published to his credit while the second rank with 33 publications is occupied by Mustafa, H. (Department of Physics, University Jordan) and the third place with 31 items each is occupied by as many as 6 authors.

The same study was also conducted with a different angle (Table 6.7-B) in which subject wise productivity of authors was found out. The results showed three most active researchers / scientists in each of 14 different fields of studies like Agriculture, Biology, Chemistry, Computers, Dentistry, Earth Sciences, Electronic, Engineering, Mathematics, Medical Sciences, Microbiology, Nursing, Pharmacy and Pharmacology, Physics.

Single verses multiple authors' contribution were also studied (Table 6.7C). The results indicated that the faculty members of Jordanian universities preferred to work mostly independently, as 48.43% of publications under study showed single authorship followed by two and three authorship patterns constituting 30.89% and 15.45% respectively.

Single Vs multiple authorship patterns were also studied with year wise contributions (Table 6.7D). The results show steady growth of S&T publications from a total of 384 items (6.03%) in 1995 to 612 items (9.62%) in 2000 and 789 items (12.40%) in 2005.

The study shows that the faculty members of Jordanian universities always give preference to single authorship followed by two and three authorship pattern in their scientific research. The apparent

reason being the scale of promotion from Lecturer to Assistant Professor; from Assistant Professor to Associate Professor; from Associate Professor to Professor, as 100% weightage is given to single author's contribution. In case of more than one authors weightage is divided among all the contributors.

8.3 TESTING OF HYPOTHESIS

Certain hypotheses were formulated in chapter-1 to conduct the scientometric study. On the basis of analysis of data, as given in chapter-six, these hypotheses are tested as under:-

Hypothesis-1

Most of the contributions of the faculty members of Jordanian Universities of Science and Technology are published in the journals brought out from Jordan.

This hypothesis is tested positive on the basis of the data given in table 6.1 (A) and 6.2 (A) that shows the ranking of periodicals and country-wise distribution respectively.

Hypothesis-2

The faculty members like to publish significantly in the foreign journals also.

Table 6.1 (A) indicates that the contribution of the faculty members in foreign journals (from USA, Australia and Germany etc.) is not quite significant as in each of these foreign journals the contribution is less than 1%.

The hypothesis is thus disapproved.

Hypothesis-3

The faculty members in Jordanian Universities mostly do their researches in newly developed subjects.

Table 6.3 shows it otherwise because most of the research publications appear in the general subject Science and Technology followed by Engineering, Mathematics, and Medical Sciences whereas the subjects like Mines and Mining Industry, Plastic, Ceramic occupy only the last three ranks in the table.

The hypothesis is thus disapproved

Hypothesis-4

Most of the faculty members like to publish in their native language.

Table 6.4 (A) showing language wise distribution indicates otherwise. English was found to be used in 93.36% of publications, followed by Arabic with only 4.76%.

The hypothesis is thus disapproved.

Hypothesis-5

The periodicals carrying the publications of faculty members are mostly brought out in Arabic language.

The data analysis given in Table 6.4 (B) indicate that as Jordanian scholars in S & T get their literature published in as many as 524 journals of which, 468 periodicals (i.e. 89.31%) publish in English Language only and 27 periodicals (i.e. 5.15%) publish in English and Arabic both. However, only 14 periodicals (i.e. 2.67%) publish their literature in English as well as in any other language except Arabic. 15

periodicals (i.e. 2.86%) publish only in languages other than English and Arabic.

The hypothesis thus, stands disapproved.

Hypothesis-6

The period of study (1995-2005) shows a steady growth in the production of scientific literature by the faculty members of Jordanian Universities.

Table 6.5 shows the data tabulated as per year-wise productivity. The table indicates a steady growth in the production of literature. It shows a growth rate of 9.89% from 1995-2000 and a growth rate of 5.33% from 2000-2005.

Table 6.7 (D) presents year-wise contribution of authors. This tables gives a general feeling of the steady growth of S & T publications from a total of 384 items (6.03%) in 1995 to 612 items (9.62%) in 2000 and 789 items (12.40%) in 2005.

The hypothesis is proved thus.

Hypothesis-7

The Faculty members of Jordanian Universities prefer to publish their contributions in form of research articles.

Data given in table 6.6 shows that 92.43% of their contribution appeared in form of Research articles only. Conference proceedings with 6.64% and books with 0.91% follow this.

The hypothesis thus stands proved.

Hypothesis-8

The productivity of the authors is linked with the subjects that mostly contribute to the development of Jordan.

Table 6.7 (A) lists the number of contributors with their decreasing productivity, whereas Table 6.7 (B) shows the subject-wise productivity of authors. The most productive authors have been found in the subjects like Agriculture, Biology, and Chemistry whereas far less productivity is reported in the subjects like Nursing, Pharmacy and Pharmacology etc. They are probably the subjects that contribute to the development of basic sciences.

The hypothesis is proved thus.

Hypothesis-9

The faculty members of Jordanian Universities believe more in collaborative research as compared to individual research.

Table 6.7 (C) shows single Vs multiple authorship pattern 48.43% of the total contributions was found to be in single authorship. This is followed by 2 and 3 authorship pattern constituting 30.89% and 15.45% respectively. This shows that Jordanian scholars prefer to work mostly independently. When it comes to collaboration in research, there first preference is two collaborators and second preference is three collaborators.

The hypothesis is therefore disapproved.

Hypothesis-10

The bibliometric laws when applied to the published output of the Faculty members of Jordanian universities, are found to be valid.

Chapter 7 deals with the application of Bibliometric Laws. Bradford's Law of Scattering when applied to the data into three zones of periodicals consisting of 10, 77 and 437 journals respectively gave the same equation $1:n:n^2$, proving its validity.

The Zipf's Law was also found valid when applied to the data collected from the titles of the contributors. However, it was difficult to satisfy Lotka's Law on the basis of the analysis of the present data.

The hypothesis is thus proved partially.

8.4 CONCLUSION

The findings of the study make it amply clear that the faculty members of Jordanian Universities in general, like to get their scientific contributions published in the periodicals issued from Jordan itself. This is evident from the fact that research articles of Jordanian scholars are published in widely distributed periodicals from as many as fifty-one countries but the seven core periodicals in which their contributions have been published are from Jordan itself.

'Dirasat' published from the University of Jordan occupies the first position amongst the top seven core periodicals. This journal, infact separately covers five main branches of Science and Technology. This and other reasons of its popularity are- its inclusion of articles in Arabic as well as in English; as also the fact that it publishes abstracts in both the languages, irrespective of the fact whether the articles themselves are written in English or in Arabic language.

The research also concluded that the scientists undertake their researches more in the fundamental subjects of Science and Technology as compared to those in newly developed subject fields. The reason attributed to it is the availability of research facilities in those subjects. Another startling revelation of the present research was the preference of the Jordanian scholars to get their research published in

English rather than in their native language. It is probably because of the fact that the publications in English language have their worldwide acceptability and thus they easily get global recognition. However, the journal 'Dirasat: Pure Sciences' has published as many as 355 items in English and only 51 items in Arabic, authored by the Jordanian Faculty members under study. Jordanian Scientists reported steady growth in the production of literature during the period of study. Even the published output was reported to have been doubled during the period from 1995 to 2005. This is mainly due to increase in the number of universities and policies of the government to invest heavily in S&T research and development programmes, i.e. 4% of the total budgetary allocation. The research articles were found to be the most common form of scientific communication by the Faculty members. The second place was occupied by the conference proceedings. In contrast to the recent trend of collaborative research followed by the scientists the world over, Jordanian Scholars were found to conduct solo research. This deviation is probably due to the criteria of giving 100% weightage to single author contributions in matters of promotion of Faculty members from lower to higher cadre.

8.5 RECOMMENDATIONS

On the basis of the Scientometric study undertaken by this researcher, the following recommendations may be made:-

1. The Jordanian Government should invest more to strengthen R&D in Science and Technology in the Jordanian Universities. Only 4% of the total budgetary allocations are not enough.
2. The planners and executive heads of the universities in Jordan may take care about the all round development of research facilities in pure and allied disciplines as well as in the fundamental and recently developed subjects.

3. The young scientists be lured and motivated to undertake research in the areas that are directly concerned with the economic and social development of the country.

4. Efforts may be made to sign the memorandum of understanding between Jordan and other countries to achieve international collaboration in such areas of S&T that are directly related to social and economic development of Jordan.

5. The scientists should try to get their research published more in foreign journals rather than in the native journals, as it will bring their research in global limelight.

6. Adequate manpower and infrastructure facilities may be developed in the subjects like Biotechnology, Nuclear Energy, Pharmacy & Pharmacology and Health Sciences, so that more researches are undertaken in these areas.

7. The overemphasis of publication in form of research article may be shifted to conference proceedings and other important forms of publications.

8. Jordanian scientists should undertake collaborative research projects to produce more qualitative results, as the team research now a days, is a common trend around the globe.

9. The criteria of giving 100% weightage to single author contributions in matters of promotion of Faculty members from lower to higher cadre may be rationalized so that it does not inhibit collaborative research.

10. Information scientists should undertake Scientometric studies in various subjects of S&T every now and then, to find out the current trends of research in order to provide better library and information services to the faculty members in Universities of Jordan.

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